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AV Communication Review

AUDIO VISUAL

The Efficiency of Different Modes of Communication

PAUL J. DEUTSCHMANN
LIONEL C. BARROW, JR.
AND ANITA McMILLAN

Single and Multiple Channel Communication: A Review Of Research and a Proposed Model

FRANK R. HARTMAN

Title VII Research Abstracts Installment 2

A. W. VANDERMEER
WILLIAM H. ALLEN

NOVEMBER-DECEMBER 1961

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Single and Multiple Channel Communication: A Review Of Research and a Proposed Model

Frank R. Hartman

The author was a staff member of the Pennsylvania State University Division of Academic Research and Services when he prepared this article under a grant from the Television Bureau of Advertising of New York. He wishes to acknowledge the support and encouragement of C. R. Carpenter and L. P. Greenhill, director and associate director, respectively, of the Division; Mr. Greenhill added materially to the clarity of exposition in several instances. Frank R. Hartman is now assistant professor of psychology at Dickinson College, Carlisle, Pennsylvania.

RESEARCH ON THE CHANNELS of modern communication media is much older than the media themselves. The media channels, after all, correspond to the human sensory modalities, of which vision and hearing are of principal usefulness.

Since the advent of motion pictures and television, however, it has become customary to subdivide the visual channel into two components: a pictorial channel (non-verbal) and a print channel (visual verbal). This division departs from the older neurological bases. The distinction is in the type of information or coding, rather than in the neural pathways utilized. Less frequently, the auditory channel is divided into two components: auditory verbal (spoken words) and auditory non-verbal (sound effects and music). The tendency to define channels according to the kind of information presented indicates the nature of the interest of the researcher in communication. He is concerned with the organization of information and its presentation to the human senses. The development of a concept of channels, therefore, has followed the line laid down by research on communications in general.

The present review deals with three channels of information presentation: the pictorial, the auditory verbal, and the print. These channels are basic to all current mass media. The more particular concern of this review is with the effects of these channels when used in combination to present information. As

such, the relevance is chiefly to television, motion pictures, and other media using more than a single communication channel. A large literature has accumulated concerning the learning of information presented by multiple channels. This paper suggests a theoretical formulation by which the diverse results set forth in this literature may be better knitted together, and also suggests clarifying experiments where reconciliation is difficult. To these ends, the writer has systematically organized the literature.

The review is divided into four sections. The second, third, and fourth of these deal with the principal topic: the learning of information presented over multiple channels. The first section reviews the literature of experiments comparing one channel with another. That such a review is necessary may surprise readers who are already acquainted with existing reviews. The writer himself was surprised to discover the following facts that call for a new enumeration: (a) No previous review provides sufficient coverage of the relevant studies, and some experiments had escaped all reviewers. (b) The reviewers, often uninformed of each other's work, reviewed different studies. (c) No complete bibliography was widely available. (d) The reviews did not include information on the sensory modes basic to the channel differences. The first section of this paper attempts to correct some of these inadequacies.

I. COMPARATIVE EFFECTIVENESS OF THREE SINGLE CHANNELS: AUDIO, PRINT, AND PICTORIAL

Although the earliest attempts to review the literature on the relative learning capacities of the sensory channels are found in reports of psychologists working on learning problems in the Ebbinghaus tradition, the first major efforts to organize the experimental results seem to have been stimulated by the extensive use of radio in the 1930's. Hollingsworth (49) devoted a chapter to the comparison of the audio channel with the visual. Elliot (25) made an extensive review as an adjunct to his own experiments with school children. Carver (15) contributed a chapter to a volume of radio research edited by Cantril and Allport. Reviews by McGeoch (85) and Stroud (120) continued the learning theory orientation. Klapper (63) included a chapter on the comparative effects of media in his monograph on the effects of mass media. This chapter was later included without the bibliography in a volume edited by Schramm (64).

The year 1950 marked two new research approaches to channel comparisons. The growth of interest in human engineering produced one of the best reviews to date, that by Day and Beach (20). A parallel development of interest in instructional film research led to a summary by Hoban and van Ormer (48)—the first review to consider the comparative effects involving the pictorial channel. Hovland (50) touched on the relative channel efficiency problem in his review of mass media research, but he based his observations on those of Klapper.

The major concern of all these reviewers except Hoban and van Ormer has been with audio-print comparisons. The principal patterns for organization of the experimental results have been the age and intelligence of the subjects; the difficulty and meaningfulness of the information presented; and the length of time between presentation of the information and the testing of the information. The conclusions of these separate

reviewers are not repeated here since the analysis to follow includes the organization and the material on which these reviews were based. Reviews of the human engineering aspects of the sensory modes by Broadbent (9), Cheatham (16), Henneman (45), and McCormick (83) will be considered in a later section.

Audio and Print Channels: Comparative Effectiveness for Nonsense Syllables and Digits

The studies which have directly compared the learning of information in the print channel with that in the audio channel are divided according to the nature of the presented information. The division is not arbitrary, but is in accordance with one of the dimensions along which there are consistent differences—the difficulty or complexity of the material. Nonsense syllables and digits, the first type of material to be considered, are relatively difficult material as compared with, say, common words. Fourteen studies are available. Eight[1] of these found the print channel more effective; five[2] studies favored audio; and one[3] indicated no differences. The results favoring audio were achieved with young children; those favoring print, with older children or adults. These results are not strictly comparable, but may be summarized as follows: Relative channel effectiveness depends on the difficulty or complexity of the material for a given group of subjects provided the subjects can read. With material such as nonsense syllables and digits, adults find print an advantage. The reading skills of younger children, however, are so limited that the audio channel is probably the most effective for them regardless of the task.

Audio and Print Channels: Comparative Effectiveness for Meaningful Words

Fifteen studies which deal with lists of meaningful words presented in serial order are here considered. Eight[4] found the print channel more effective; three[5] favored audio; and four[6] found no differences. The studies supporting the audio channel used material suitable for young children. The findings favoring the print channel are all derived from studies with adult subjects except for the study by Carver (15). In every case indicating a print advantage, the material—such as foreign vocabulary and spelling—is relatively complex. Three of the "no difference" cases can be dismissed: (1) Swift (122) found results which fluctuated with difficulty level. (2) Quantz (105) was dealing with a single subject. (3) Carlson and Carr (13) experimented with rather unclearly differentiated "vocalizable and unvocalizable" words; these results are thus difficult to interpret within the context of the other experiments. The findings are in accord with the previously stated generalization: the print channel becomes more effective relative to the audio as the difficulty of the material for the subjects increases provided a fair degree of literacy is present.

[1] Carver (15), Conway (18), Gates (32), Koch (67), Krawiec (69), Munsterberg and Bigham (95), Smedley (116), and Whitehead (125).

[2] Carver (15), Conway (18), Hemmon (44), Smedley (116), and Von Sybel (123).

[3] O'Brien (100).

[4] Calkins (11), Carver (15), Frankl (29), Kay (59), Kemsies (60), Kirkpatrick (62), Lay (75), and McDougall (84).

[5] Carver (15), Hawkins (42), and Pohlman (104).

[6] Carlson and Carr (13), Kemsies (61), Quantz (105), and Swift (122).

Audio and Print Channels: Comparative Effectiveness for Meaningful Prose

Twenty-three studies have compared the effectiveness of audio and print channels in presenting educational talks, passages selected from fiction, essays, and advertisements. Superiority of audio was supported by eleven[7] of these, print by nine,[8] and three[9] found no differences. All of the studies favoring print deal with adult subjects and complex stimulus material. Again, the studies supporting the relative effectiveness of the audio channel used young children as subjects, or adults and older children with simpler information. There are two exceptions: Williams (127) found loud speaker presentation of a lecture more effective than a printed lecture for college students. Erickson and King (26) found audio superior for grades one through nine. Despite these exceptions, the generalization for nonsense syllables, digits, and meaningful words may be said to apply to meaningful prose also: the effectiveness of print relative to audio increases as the difficulty or complexity of the material increases provided the subjects are literate.

Pictorial Channel's Effectiveness Compared With Audio and Print

Studies involving the pictorial channel comparison are too few to permit differentiation by kind of subject matter presented. Also, their comparability is not satisfactory—a fact to be kept in mind in appraising the results.

Only fourteen studies of pictorial comparisons have been found. Five[10] of these found advantage for the pictorial channel over the print. Six[11] found a superiority for pictorial over audio, and three[12] studies found no consistent differences. (Of the six, Pohlman (104) used actual objects rather than pictures of them.) The weight of the studies certainly favors the pictorial channel. This generalization, however, may not be expressed with the same confidence as the audio versus print generalization because: (a) it is based on fewer studies; (b) the older studies are defective in experimental design and measurement; (c) the testing always involved verbal items, a fact which surely worked to the disadvantage of the pictorial channel; (d) the relative difficulty of the pictorial and verbal information is neither known nor controlled; (e) finally, the studies of Nelson (97) and Nelson and Moll (98) compare the effectiveness of the visuals in films with their sound tracks, a precedure which introduces many possibilities for bias.

Some speculation has been advanced concerning the seeming superiority of the pictorial channel. A position summarized by Miller *et. al.* (89) is that pictures present more cues which can

[7] Burtt and Dobell (10), Carver (15), Dewick (21), Elliot (25), Erickson and King (26), Goldstein (35), Lacy (71), Russell (111), Stanton (119), Williams (127), and Young (129).

[8] Carver (15), Corey (19), Haugh (41), Henneman (45), Krawiec (69), Larsen and Feder (73), Lumley (78), Mead (86), and Russell (111).

[9] Green (37), Russell (111), and Worcester (128).

[10] Calkins (11), Hermann, Broussard and Todd (46), Kirkpatrick (62), Moore (90), and Pohlman (104).

[11] Calkins (11), Kirkpatrick (62), Moore (90), Pohlman (104), Sumstine (121), and Weber (124).

[12] Laner (72), Nelson (97), and Nelson and Moll (98).

be used for discrimination, provided these cues are present when the discrimination is tested. Such speculation, however, seems somewhat premature. The empirical evidence must be considerably strengthened before any theory may be proposed with confidence.

Discussion of Single Channel Comparisons

Before proceeding to generalize from the studies among which there is considerable agreement, some attention should be paid to those experiments which have yielded contrary results. The pattern of results among the dissenting investigations is not sufficiently consistent to warrant serious theoretical attention. Some inconsistencies are perhaps the result of vagaries of sampling; others may be a product of weaknesses in experimental design including lack of randomization, improper control of conditions, insufficient number of replications, invalid or unreliable tests, and lack of probability statements. The older studies, of course, are most deficient along these lines. Some reviewers have suggested an arbitrary cut-off date prior to which all studies would be unacceptable. But this cut-off would eliminate some very enlightening studies —those of Munsterberg and Bigham in 1894, for instance. The only possible recommendation is that weaknesses of certain studies must be kept in mind in evaluating their findings.

Two other explanations may be suggested for certain of the discrepancies. The first is the yet-to-be-deduced relationship between the situation in which information is presented for learning and the situation in which the learning is tested. To test an audio presentation against a print presentation, and then measure the effect on written test is probably disadvantageous to the audio presentation. Disadvantage to a print presentation is also probable when it is tested by means of the audio channel. This discrepancy is uncontrolled in a large number of the reported studies. An attempt to discover a consistent test channel bias in the various studies was not successful, but this does not eliminate the possibility of such a bias as an important factor in specific experiments.

A second tentative explanation of the discrepancies applies only to presentations and tests involving the audio channel. When subjects are permitted to observe the lips and facial movements of a speaker, the intelligibility may be increased. This effect is implied by the results of Williams (127), and was systematically investigated by Neely (96) under conditions of noise. Unfortunately, information concerning this aspect of the experimental situation is not adequately reported in many of the studies reviewed, and systematic comparisons are not possible.

If we consider the exceptions as minor empirical aberrations, this generalization is possible concerning the majority of the studies comparing effectiveness of the audio and visual channels: Audio is a more effective channel than print when the information presented is simple and easily understood by the subjects, and for illiterates and semi-illiterates (*e. g.* children) regardless of the difficulty of information.[13] Print shows increasing advantage over audio for literate sub-

[13] Previous reviewers have noticed an advantage for audio when a delay intervened between the presentation and the testing of the information. This generalization was not investigated in the present review because the recall situations were divergent in so many respects as to make comparisons impossible.

jects roughly proportional to the increasing difficulty in their comprehension of the material. This generalization does not differ in any important respect from those made by previous reviewers, although increased confidence is possible because of additional studies.

Propositions as to Sensory Modes

Since new studies do not seem to be modifying the empirical generalizations at this level, it would seem desirable that future studies be designed to achieve a more basic level of explanation. One suggestion of a direction that such experimentation might take may be found in some propositions concerning the nature of the sensory modes upon which our conception of channels is based. The most appropriate paper in this area is a review by Cheatham (16). This paper is difficult to obtain. An apparent summary of it was published by Henneman (45) as an introduction to an experiment he made. A further condensation made by McCormick (83:427) seems so satisfactory to the present purpose that it is reproduced here:

1. Auditory stimuli are essentially temporal in nature. . . . Visual stimuli, however, are characteristically spatial. . . .
2. Auditory stimuli typically arrive sequentially in time, whereas visual stimuli may be presented either sequentially or simultaneously.
3. . . . auditory stimuli . . . have poor 'referability,' meaning that they usually cannot be kept continuously before the observer, although they can be repeated periodically. Visual stimuli offer good referability, because the information usually can be 'stored' in the display.
4. Auditory stimuli offer fewer dimensions for the coding of information than do visual stimuli.
5. Speech (as one form of auditory stimuli) offers greater flexibility such as off-the-cuff variations in connotations, nuances, and inflections. Visual stimuli, on the other hand, require advance coding.
6. The 'selectivity' of messages in speech offers a time advantage, since the pertinent information is already selected for the receiver. With visual stimuli, however, searching for information may be necessary, as in looking for information from tables, charts, maps, etc.
7. The rate of transmission of speech is limited to the speaking rate, whereas visual presentations can be faster.
8. Auditory stimuli are more 'attention-demanding'; they 'break in' on the attention of the operator. Visual stimuli, however, do not necessarily have this captive audience; the operator has to be looking toward the display in order to receive the stimulus.
9. Hearing is somewhat more resistant to fatigue than is vision.

McCormick's third proposition seems a plausible explanation of the increasing advantage of the print channel as the information becomes more difficult. Comprehension of a difficult unit of a message may be aided by reference to previous and subsequent units in the sequence. Such referral is not possible in the audio channel. The fourth proposition also concerns advantage for print. As any student of anatomy knows, the neural pathways from the eye to the brain are much more numerous and varied than those from the ear. Thus, theoretically, the capacity of the eye far exceeds that of the ear. However, Jacobson (52 and 53), who has analyzed the informational capacities of both organs, suggests that the brain is capable of utilizing only a very small percentage of the information conveyed by either the eye or the ear (less than 1 percent in the case of the ear). To account for the brain's failure to utilize much peripheral stimulation, Broadbent (9) proposes a provocative explanation: filtering in the central nervous system.

McCormick's fifth proposition may be related to the advantage of the audio channel with easily comprehended material, since the widely varied possibilities of vocal emphasis and punctuation greatly exceed those of print symbols having similar purpose, and may well be more readily perceptible. His eighth proposition, also, may shed light on the instances of audio advantage. However, the experiments supporting its superior attention-getting have all involved subjects whose attention focused on some other task. Superior ability of auditory stimuli to *retain* attention has not yet been demonstrated.

The accumulated evidence is not sufficient to allow generalization from the studies comparing the pictorial channel with the audio and print channels, but—as has been noted—the results tend to favor the pictorial. Further experimentation attempting to confirm this observation is necessary.

We have now completed our comparisons of three channels used independently—the pictorial, audio, and print—as to their effectiveness in inducing learning. We shall now consider simultaneous presentation of information over multiple channels.

II. MULTIPLE PRESENTATION COMBINATIONS OF PICTORIAL, PRINT, AND AUDIO CHANNELS

Details of Experimental Model

Multiple channel presentations involve at least two of the channels under consideration. Although television and sound motion pictures are examples of multiple channel media, the typical experimental situation is much simpler than any everyday experience with those media. Partly because of its great simplification, the experimental situation may be termed a *model* of the general case in which information is simultaneously presented over several channels.

Before proceeding with a review of the experimental results, it is necessary to consider the details of this experimental model. An analogy of the model may be helpful. A newscast is presented over television. Pictorial material with print titles appears on the screen accompanied by the voice of the newscaster. When the newscast is finished, a test is administered to the viewers to determine how much of the presented news they learned.

In generalizing terminology, information is presented simultaneously over some combination of the audio, print, and pictorial channels. The effectiveness of the communication is measured by some kind of test administered to the recipients.

The requirements of experimental design have imposed considerable formality upon the experiment which parallels the newscasting analogy. Where the newscast permits considerable variation in the employment of the three channels, the experiment requires simplification. Continuous simultaneous presentation is the most common experimental usage of channels. When channels are alternated in presenting information, the number and length of the alternations is carefully arranged.

Likewise, the information presented in the experiment is usually much more formal than newscast material. Lists of nonsense syllables or meaningful words are the most common type of information utilized in experimental presentations. When other materials such as prose passages are used, the difficulty of the material is usually first assessed.

In multiple channel experimentation, the relation of the information in each channel to the information in other channels *should be specified*. There are four possibilities here: (a) Two channels may present *redundant* information such as the same word, printed and spoken. (b) Two channels may present *related* information such as a pictorial representation of an object and verbal description of the object. (c) Channel information—such as a picture of a tree in the pictorial channel and the word *nine* in the audio—may be *unrelated*. (d) The information presented may be *contradictory* as in the simultaneous presentation of the printed word, *woman*, and the spoken word, *man*. Scaling methods for meaningful materials such as Osgood's also may be applied. In experimental practice the relationships of information among channels *have not been specified*, but usually related or redundant information has been used. In those studies which have mentioned the relation of information among channels, the relationship has been subjectively rather than operationally determined.

Testing of Learning

An important aspect of multiple channel experimentation is the testing of the information which has been presented. While considerable assessment of the commercial media takes place, commercial communications usually are not designed to include tests and other response measures. With the experimental model, the criterion of the success of the communication is always specified. Some measure of learning is the most usual index of communications, although attitude scales, sales volume, and other indices of a communication's persuasiveness are also utilized. This review, however, is limited to studies which had learning in the more formal sense as their objective.

The experimenter has considerable latitude in his choice of a criterion of learning. The recipient of the information may be asked to reproduce it subsequently, or to recognize it within a context of related information. Reproduction or recall has been a popular learning measure in comparisons of the audio and print channels. However, since reproduction of pictorial information is difficult, recognition is a more satisfactory criterion for experiments involving the pictorial channel.

The use of a recognition criterion requires some additional considerations. The previously presented information is now embedded in similar but not previously exposed information. A question arises as to what channel or combination of channels should be used to present the information a second time to test for recognition. This problem also arises with associative learning for similar reasons. Much importance will be attached to this question in the discussion which is to follow. Most experimenters have used the print channel alone for testing, regardless of the channels utilized in the original presentation.

However information is presented for testing, there are several responses which the recipients may be required to make. The most common of these is writing. The written response may take the form of meaningful words, or a check, a cross, or other indication of a choice from several alternatives. Among other methods of response used to indicate choice is the manipulation of electrical or mechanical switches. Vocal response, also, is utilized, particularly when reproduc-

tion of the original information is required. Is the mode of response an important variable affecting learning comparisons under multiple channel conditions? Investigations of this aspect of communications have yet to be made.

In summary, the experimental model we are examining is as follows: Simple information, such as lists of meaningful words and pictures of common objects, is presented over combinations of the audio, print and pictorial channels. The information thus simultaneously presented is usually redundant or related, but may be unrelated or contradictory. Recipients of the information are always tested to determine how much they learned. The test may require reproduction of the information, or it may require the recipient to recognize the information within a context of similar material. The second presentation of the information for testing may be made with any combination of channels. However, single channel testing, usually print (a written test), is most common.

The experimental model is rather removed from the media situation to which we should like to apply the results. A particular discrepancy to be noted is the experimental requirement that the recipient pay attention to the presented information. Without this requirement the experimental results would, of course, be uninterpretable. Nevertheless, the effect of this imposition on the validity of the extrapolation of the experimental results has not yet been determined. This lack, together with reservations about the other experimentally imposed formalities, should be kept in mind when attempting to generalize from the experimental literature.

Redundant Information: Audio Plus Print Compared with One Channel Presentation

Mass media often use audio and print channels simultaneously to present the same verbal message. This case of redundant information in two channels is the only case likely to occur in mass media simultaneous usage of these particular channels. The cases of related, unrelated, or contradictory information occurring simultaneously in the audio and print channels are theoretically possible, and have been studied in a limited number of experiments which will be reviewed later. The experiments reviewed at this point are all comparisons of simultaneous audio-print presentations with either audio presentations alone, or with print presentations alone.

The empirical results are as follows. Of nine studies comparing simultaneous audio-print presentations with audio presentations of the information, four [14] indicated superiority for the combined channels, two [15] favored audio, and three [16] indicated no differences. With regard to the comparisons of simultaneous audio-print with print, seven [17] studies supported the simultaneous presentation, and two [18] found the presentation equivalent. Hartman (40) found the audio-print combination to be the most consistently effective of seven possible combinations of three channels tested. It is apparent that a simultaneous audio-print presentation is more effective than either audio or print alone when

[14] Elliot (25), Koch (67), Munsterberg and Bigham (95), and Smedley (116).

[15] Henmon (44) and Schuyten (112).

[16] O'Brien (100), Pohlman (104), and Quantz (106).

[17] Elliot (25), Henmon (44), Koch (67), Munsterberg and Bigham (95), Pohlman (104), Smedley (116), and Young (129).

[18] O'Brien (100) and Quantz (105).

the information simultaneously presented is redundant.

These experimental results are reasonably clear-cut, but difficult to interpret. The theory has been advanced that increases in learning produced by increases in available cues are not to be expected unless the additional cues are available when the learning is tested. In the case considered here, we have been concerned with information presented simultaneously in the audio and print channels, tested in either the audio or print channels. Contrary to the theory just stated, the simultaneous presentation proves more effective despite the fact that the additional cues are not present when the information is tested via single channel.

McCormick (83) points out the similar facilitation of reaction time from combined audiovisual stimulation. The question of the possibility of simultaneous acquisition of information through different sensory channels is of relevance here, and will be discussed in more detail subsequently.

Related Material: Pictorial Plus Verbal Presentation Compared with One Channel

The studies reviewed here have all compared pictorial-verbal presentations with either print or audio. In most cases, pictorial and verbal surrogates for the same object or situation were used. The information in the channels, therefore, was related. Testing the learning of the information was either by recall or recognition except in the studies of Kale (56) and Kale and Grosslight (57) investigating association learning. The presentation of the information for testing was always verbal (printed or spoken) except in the studies just noted which also used pictures as stimulus materials in the testing situation.

The number of studies involving simultaneous pictorial channel presentation is not sufficient for subdivision according to variations in the presentation or testing situation. Even taken as a whole, the number is inadequate for generalizations. Thirteen studies are reported. Four [19] supported the superiority of the pictorial and audio channels over the audio alone; three [20] studies found audio-pictorial presentations better than pictorial alone. Jones (54) found motion picture presentations of novels superior to the reading of them in one respect: the movie produced more understanding as measured by an essay. Weber (124) found pictorial and audio in combination better than a pictorial presentation, but Sumstine (121) found the opposite. Pohlman (104), who used real objects—rather than pictures—plus printed verbal descriptions of the objects, found them superior to an audio-print presentation of the verbal surrogates. Jorgensen (55) could show no differences between a television newscaster presentation and a newscaster with motion and still picture illustrations. While his study does not utilize the channels of major interest, it does contribute evidence on the addition of a pictorial component.

Three additional studies—whose relation to those already cited is peripheral rather than central—may be listed. Bousfield, Esterson and Whitmarsh (8) successively added black and white, then colored pictorial representations of ob-

[19] Barrow and Wesley (6), Goldberg (34), Nelson (97), and Nelson and Moll (98).

[20] Nelson (97), Nelson and Moll (98), and Pohlman (104).

jects to verbal descriptions, and achieved an increment of learning with each addition—a very surprising result in view of the wholly verbal testing. Kale (56) investigated English-Russian word associations, adding sound and pictorial surrogates to a basic print presentation. This situation, when analyzed in terms of the previously suggested model, is quite complex. The results reflected the complexity, but tended to support the advantage of the pictorial addition. It should be noted that in the Kale experiment the additional pictorial cues were also present when the information was tested. A subsequent study by Kale and Grosslight (57) found superiority for a print-pictorial combination, but not for audio-pictorial versions. Hartman (40) also found audio-pictorial the least satisfactory of the verbal-pictorial combinations.

The comparisons of pictorial-verbal presentations with single channel presentations strongly indicate advantage for the combination of channels. Despite these consistent results, there is good reason for caution in accepting them. The studies are few and different in design. In those studies comparing motion picture and television presentations of complex material with verbal presentations, the conditions for the comparison were not fair to the verbal channels, the verbal presentation being simply the sound component alone which was not designed for independent presentation.

Regardless of the validity of the general conclusion, a more basic approach to multiple channel presentations is necessary. For the remainder of the paper we shall be concerned with a synthesis of theoretical views and experiments based on the experimental model previously presented. The case of redundant information simultaneously presented in the audio-print channels has already been discussed. We shall now consider the stimulus generalization model for simultaneously presenting and testing information in multiple channels; the possibility of interference among channels; the special problem posed by association learning with multiple channels; and the kinesthesis-participation-practice controversy.

III. STIMULUS GENERALIZATION MODEL FOR INFORMATION SIMULTANEOUSLY PRESENTED

The stimulus generalization model predicted that learning of *related* and *unrelated* information simultaneously presented by multiple channels increases as the situation in which the learning of the information is tested becomes more similar to the situation in which the learning was presented. The derivation of this model is lengthy and has been given by Hartman (40). A somewhat briefer version, but retaining all the references, will now be developed.

Morris (91), Carpenter (14) and Gibson (33) have noted that the *significance* of *cues, signs or symbols* varies in the degree to which they retain the properties of their referents. Gibson distinguishes between *conventional surrogates,* arbitrary words and linguistic symbols, and *nonconventional surrogates* such as pictures. He also notes that the degree of relationship between a picture and its referent depends on physical stimulus similarity.

Elliot (25) noted that the comparative effectiveness of the audio and print channels could not be properly appraised unless both channels were also used to test the learning. Reed (107) reports data on recall of meaningful

words which indicates that audio and print presentations were more effective when the testing was by the same channel as the original presentation. Roshal (109) stated the problem more formally, and noted that learning gains resulting from increased correspondence between the presentation and testing situation were deducible from the proposition that the probability of any stimulus' evoking a response was increased as the similarity of that stimulus to a second stimulus which had already evoked the response was increased—the definition of the phenomenon of stimulus generalization in SR terminology. Roshal tested the formulation by making films of knot tying from a variety of camera angles. He demonstrated that the film whose camera angle was identical to the subjects' view in practicing with the knots was the most successful. Further work by Kale (56) failed to show that verbs (action words) could be illustrated more successfully with motion pictures, and nouns (static words) with still pictures. Lefkowith (76 and 77) confirmed the stimulus generalization hypothesis for pictorial representation by demonstrating that a line drawing presentation led to better learning than a still picture presentation on a line drawing test, and that still pictures, in turn, surpassed line drawings when the results were measured by a still picture test. Hartman (40) showed that the stimulus generalization model could be applied to the resulting differential amounts of learning from the seven possible presentation combinations of the audio, print, and pictorial channels tested on the same combinations of the three channels.

Miller *et al.* (89) give an excellent discussion of stimulus generalization applied to communication mass media. Hartman (40) has modified and synthesized this position as follows: Stimulus generalization is an empirical observation that similar stimuli tend to evoke similar responses. An interpretation of this empirical generalization may be proposed which is somewhat similar to the theories of Guthrie and Estes. Generalization between two stimuli is a function of the number of cues which they posses in common. If a response has been learned to a stimulus, it may be argued that the subject has learned to respond to various cues or substimuli which the stimulus possesses. As the number of identical cues associated with two stimuli is increased, the probability that a response associated with one stimulus will be elicited by the other increases. In probabilistic terms, if a single cue can evoke a response, and if every cue of a previously learned stimulus has equal probability of such elicitation, the probability that a given response will be evoked by a second stimulus increases as the number of cues common to both stimuli and sufficient for the response increases.

If the two situations in which information is (a) presented for learning and (b) then presented again for testing are looked upon as two complex but similar sets of stimuli, the learning demonstrated in the second or testing situation may be expected to increase as the testing situation becomes more like the original situation in which the information was learned. This leads to the expectation that single channel testing such as the usual printed questions will not elicit fully the learning from a multiple channel medium. It is also to be expected that adding cues to the stimulus to be learned enhances its probability of evok-

ing the response, since there are more handles available for the learner to grasp. However, these cues will have little effect if they are not present in the situation where the learning is used and tested. Pictorial illustration of print and audio should facilitate learning provided the pictures relate properly to the words, and do not interfere. Facilitation among multiple channels may be expected, but only with multiple channel testing.

Now that we have proposed this theory, it is desirable to discuss objections to it. First of all, cues are not equal in their probabilities of eliciting responses. Some cues are more likely to elicit response than others. Miller calls cues with high probabilities of response *relevant cues* and cues which have little probability of being used, *irrelevant cues*. Therefore, the addition of some cues is facilitating; the addition of others is not. Still other cues, as Miller *et al.* point out, may add only interference. Laner (72) analyzed the responses to a written test of learning from a motion picture, and concluded that emphasis on relevant cues was more important than fidelity of presentation. But with relevant cues, as with certain types of information theory, the probabilities of effectiveness should be determined in advance—a difficult matter and often impossible. Furthermore, this discussion assumes that the probabilities are independent rather than conditional, an assumption which in many instances of perception is not justified.

Second, this adaptation of the stimulus generalization model is most appropriate for discrimination learning, but discrimination is more complex than it has been made to appear. French (30), for instance, has demonstrated that different percentages of reinforcement yield strikingly different amounts of generalization for stimuli with identical cues in common.

Finally, there are some empirical facts which do not fit too well. From stimulus generalization theory we would expect that additional cues which are not present when the learning is tested will not induce additional learning. As has been already noted, the simultaneous presentation of redundant information in the audio and print channels is one exception. Another exception is found in the experiment of Bousfield, Esterson and Whitmarsh (8) which achieved additional learning from additions of pictures but without use of the pictures when the learning was tested. Hartman's findings, however, are to the contrary.

There are still other problems in applying the stimulus generalization model to multiple channel learning presentation. However, work which may be of considerable interest to researchers in the mass media is proceeding. A very timely review of the stimulus generalization literature by Mednick and Freedman (87) has recently appeared. A major problem—now partially solved—was to extend the stimulus generalization model to the cognitive areas and to multiple dimensional stimuli. Dicken (22), Diven (23), Haggard (38), Lacey and Smith (70), and Razran (106) have achieved stimulus generalization gradients along meaning continua. Shepard (114) has produced and successfully tested a multiple dimensional model for which stimulus generalization gradients have been obtained. The remaining difficulty is to apply the model to the situation where alternation of attention among stimuli is possible. Shepard and Jenkins (115) report an unsuccessful

assault on this problem using complex pictorial stimuli. (In this situation, translated into multiple channels, the subjects may disregard the information on one of the channels under conditions of simultaneous presentation.) But research is continuing and a solution may be in sight. Some of the difficulties encountered in extending the stimulus generalization model are undoubtedly cases of interference in attention to the information, or interferences produced by the meaning of the information itself. We shall now turn our attention to the relevant experiments on both matters.

Interference Among Channels

The observation that interference may occur when information is simultaneously presented is as old as multiple channel research itself. In 1894, Munsterberg and Bigham (95) experimented with unrelated information in two channels under conditions of alternate and simultaneous presentation. They noted reduced learning under these conditions when contrasted with single channel presentations, and also noted that the audio channel seemed more resistant to interference. However, the difference in difficulty of information between the channels is a more likely contributor to this difference than the supposed audio advantage.

No further investigation along these lines occurred for a period of almost fifty years, probably because multiple channel research concentrated on the redundant case where interference is not likely to occur. However, some experimental designs produced interference accidentally. Koch (67) noted interference with alternate presentations of the audio and print channels. Two studies, one by Heron and Ziebarsh (47), the other by Williams (127) found audio presentation superior to a live speaker, and postulated interference from distraction in the live presentation. Laner (72) found interference and facilitation between a film and its sound track. Kale and Grosslight (57) also found sound track interference with a simple educational film for teaching foreign vocabulary. Hall (39) reported facilitation and interference among pictures and various kinds of printed titles. Lumsdaine and Gladstone (81) noted interference when humor was added to both channels of a vocabulary teaching film. Neu (99) also found interference from attention-getting devices.

None of the above studies went beyond the reporting of the occurrence of interference. It remained for those who applied information theory to the military problems of human engineering to reinstate the experimental paradigm of Munsterberg and Bigham, although usually without noting the original authorship. Henneman (45) examined the effects of introducing a simultaneous motor task on the learning of meaningful prose passages. The audio channel proved more resistant than print under these conditions. Mowbray (92) investigated the case of simultaneous presentation of unrelated information (letters and digits) over the audio and print channels. He observed, as had Henneman (45) and Munsterberg and Bigham (95), that the audio channel had superior resistance to interference. He also noted that the more difficult alphabetic information suffered more than the numerical information. Mowbray (93) made further investigations with meaningful prose passages. In these experiments the scanning of the print was greatly reduced by presenting the ma-

terial by tape, with vision restricted by an aperture to about one third of a line. Under these conditions the audio advantage in resistance to interference was reduced to a non-significant level, but the superior resistance of difficult material when paired with easy persisted. Mowbray concluded that simultaneous attention was only possible when the difficulty of the information presented was low enough to permit attention to alternate between channels. In a third experiment, Mowbray (94) confirmed the indivisibility of attention with difficult material. In this experiment the information presented was utilized in completing outline maps. Print proved more resistant to distraction, in this instance, perhaps an indication that the generalization of an audio advantage under conditions of distraction is limited. Klemmer (65) corroborated the superior resistance to interference of the more difficult of two simultaneously presented information series. He also found superiority for the print channel, but the finding was contaminated by the direction of the difference in difficulty and by the difference in the mode of the coding (frequency-coded tones, position-coded print). In a more carefully controlled experiment, Klemmer (66) used colors for visual information and tones for audio. After equating difficulty in single channel presentations, he obtained an advantage for the visual presentation under simultaneous interference conditions. The unique nature of the information presented makes integration with previous findings difficult, however. It is unknown whether this effect would be obtained with more meaningful information. Spilka (118) noted that the addition of print cues improved the comprehension of auditory information under conditions of noise. Hartman (40) confirmed the hypothesis of greater interference in the less difficult channel.

The scope of the experimentation on interference is limited almost entirely to the case of *unrelated* information simultaneously presented by the *audio* and *print* channels. Within this scope three generalizations seem possible: (a) that interference occurs when unrelated information is simultaneously presented and attention cannot be successfully alternated, and that it reduces the learning in both channels; (b) that increasing the difficulty of the presented information results in increasing losses through interference; (c) that when the information presented in the channels is of unequal difficulty, the less difficult information suffers the greater loss.

Advantage for either the print or audio channel in resistance to interference seems specific to other conditions. One of these may be the nature of the task under which learning is measured, as we discussed previously. Experimentation on comparative channel resistance must be careful to avoid the initial differences in the difficulty of information which have contaminated other studies.

The Mowbray and Klemmer experiments are of particular interest for the light they shed on the possibility of simultaneous sensory learning. Mowbray (93) interpreted his results as negating this possibility; he was particularly critical of Hebb (43) among others who were favorably disposed to accept this possibility. Broadbent (9), who is inclined to accept the Mowbray experiments, concluded that learning of simultaneously presented unrelated information may occur only when some alternation of attention is possible. He discusses the problem at some length in

regard to his own proposition of filters in the central nervous system.

It is evident that presenting unrelated information in several channels simultaneously compels the recipient of the information to alternate his attention among the channels. As the information becomes more difficult or more complex, the recipient becomes less successful in this alternation, and may finally abandon one of the competing channels, concentrating his attention upon the other. How often the average television viewer encounters this type of interference is unknown, but if television presentations are unsuccessful in coordinating their communication channels, it may be much more frequently than one would imagine.

Since the alternation of attention required by the presentation of unrelated information in several channels reduces the learning in all channels, multiple channel presentations clearly have no advantage under these conditions, and, indeed, may be inferior to single channel presentations. Facilitation does not exist under these conditions. However, competing information is only one type of interference. Interference may also be generated by adverse cognitive relationships in information. We shall consider this possibility in the following discussion of the association under multiple channel conditions.

Multiple Channel Association Learning

Most of the studies previously reviewed have dealt with recognition, discrimination, or recall of all the presented information. Under conditions of association learning, one part of the information is learned as a response to the other. The information which serves as a stimulus is presented during both learning and testing. The information serving as the stimulus and that serving as the response may be either related, unrelated or contradictory. Various combinations of channels are possible for presenting both the stimulus information and for the response information which is to be associated. In testing for learning, different combinations of channels are possible for the presentation of stimulus information. The response has typically been written or oral reproduction of the information to be associated. As such, the testing of pictorial information has not been satisfactory, although the problem is easily solved if discrimination (recognition) rather than reproduction is substituted as the task.

Four studies have investigated the channel contribution to association. Lumsdaine (79) pioneered with his doctoral dissertation, of which there is a more readily accessible abridgment (80). He investigated all possible pairings of words and pictures in the stimulus and response positions; *e.g.*, word-picture, word-word, picture-word, and picture-picture.

In all cases, the subject responded with a written word. Three different groups were investigated: (a) college students, mass tested; (b) grade school students, mass tested; and (c) college students, individually tested. For all three conditions the picture-word association proved superior and the word-picture association, inferior. The word-word and picture-picture associations were intermediate. Lumsdaine interpreted these findings as supporting his hypothesis that pictures are superior stimulus information for association and inferior response information, while words are superior response information and inferior stimulus information. Com-

paring the word-word and picture-picture conditions, for which Lumsdaine made no predictions, the word-word association was superior for both mass tested groups, and the picture-picture association was superior for the individually tested groups.

Bern (7) designed an experiment along the lines of Lumsdaine's, but differing in two respects: (a) he substituted discrimination for recall, allowing the pictorial response to be represented; (b) the subjects were all individually tested college students. He found association conditions of picture-picture and word-picture superior to picture-word and word-word, the order of differences being the order given. He concluded that pictures make better response terms than words. Bern also made an attempt to measure the learning in terms of changes in the facial musculature.

Interpretation of the results of Lumsdaine and Bern is complicated by their random pairing of items of information to be associated. The extent to which the items paired were related, unrelated or contradictory is unknown. Two other studies avoided this difficulty by choosing to associate foreign printed language and pictures, thus achieving the condition of unrelated information between the verbal-pictorial channels. Kale and Grosslight (57) used pictorial and English and Russian verbal descriptions of common objects. They found the picture-word association slightly, but not significantly, superior to the word-word association. They used recall as the measure of learning rather than discrimination in two channels. Kale and Grosslight also added English surrogates to the Russian, producing related pictorial and print information to be associated with unrelated Russian. This condition produced a significant advantage over the word-word associations. As mentioned previously, the addition of sound in the Kale study produced interference. Kopstein and Roshal (68) further tested the association of pictures and English words with Russian words, using recall. They found picture-word association learning superior to word-word association both in a picture-word testing presentation and in word-word testing presentation. It should be noted that the difference was much larger under the picture-word testing than the word-word.

To derive their hypotheses, both Lumsdaine and Bern have postulated chains of intervening subassociations between the stimulus and the response information to be associated. Lumsdaine cites a study by Pan (102) which indicated that better association between unrelated words could be achieved by providing words that mediated between stimulus and response. Lumsdaine's derivation is quite complex, and the following simplification is perhaps an injustice. Pictures make good stimuli because they do not evoke competing verbal associations. Words, on the other hand, do evoke competing verbal associations, and for this reason, are poor in the stimulus position. Words, according to Lumsdaine, make better responses than pictures because they possess a greater variety of associations which can be attached to the stimulus. Second, verbal associations are less specific than pictorial associations and, therefore, are easier to attach to a given stimulus.

Bern (7) bases his argument along the lines of Osgood's discussion of mediation (101). He cites studies of Dorcus (24) and Karwoski, Gramlich

and Arnott (58) which showed that free association to pictures produces operational responses, while free association to words calls forth many contrasting words. These contrasting words, reasons Bern, are almost as likely to become conditioned to a stimulus as the original response word which called them forth. Bern reconciles his results with those of Lumsdaine by contending that Lumdaine's recall testing required an additional verbal association with the picture which reduced the effectiveness of the picture in the response term.

When all four studies are considered together, the weight seems to favor Lumsdaine's conclusion that pictures are superior as stimulus information, particularly if the possibility of competing response association is small, as was the case with the Russian word studies. Since the extent and nature of the stimulus-response interference is unknown in both the Lumsdaine and Bern studies, generalization for these conditions does not seem possible. Bern's finding of better performance for conditions involving pictorial response with the introduction of pictorial testing is in agreement with the stimulus generalization hypothesis for presentation and testing conditions. The present experimental results certainly are not sufficient confirmation for the hypothesized association mechanisms which have been formulated.

The Kale and Grosslight (57) study found increased learning with the addition of English subtitles. Since these titles were also present in the testing of the learning, these results would be expected under the stimulus generalization hypothesis. Results not expected under the hypothesis have been found in a series of experiments which dealt with multiple channel association learning without terming it as such. These studies, originating with Gagne and Baker (31), have found that the association of verbal response with pictorial stimuli has resulted in improved discrimination of the pictorial stimuli without use of the verbal cues when the discrimination was tested. The results so far are not unanimous. Seven [21] studies yielded positive results and five [22] were negative.

This evidence must be regarded as inconclusive, but the possibility of learning facilitation through association is one which requires the attention of multiple channel experimentation. There is better evidence to support the notion of interference through cognitive association. But, once again, the available experiments simply concern the existence or non-existence of the interference phenomenon. What is needed is controlled experimental variation of the cognitive relationships under multiple channel conditions. Until this need is met, it is impossible to go beyond the generalization that both interference and facilitation may result from the cognitive relationships among information in various channels, and that occurrence of both phenomena is independent of any expectation derived from the stimulus generalization hypotheses.

Participation: Kinesthesis or Practice?

Participation is the active reproduction by the recipient of the information presented during learning trials. Such

[21] Cantor (12), Baker and Wylie (4), French (30), Gagne and Baker (31), Goss (36), McAllister (82), and Rossman and Goss (110).

[22] Arnoult (2), Cleff (17), Lawshe and Cary (74), Robinson (108), and Smith and Goss (117).

participation has been observed to enhance learning. The studies reported here are not exhaustive but furnish some documentation for this observation. Fourteen studies are reported. Nine [23] are in favor of the generalization, and four [24] against. One study by Ash and Jaspen (3) showed that concurrent participation (tying knots) during a film presentation facilitated learning if the film had a slow rate of development, and inhibited learning if the film had a rapid rate of development.

The effectiveness of vocalization of information in increasing the learning of that information seems clearly established. But what is the nature of the phenomenon? Older writers attributed the learning increases to the added kinesthetic cues which the vocalization process introduced. Some tangential support for this view may be found in the experiment of O'Brien (100), who demonstrated that inhibiting subvocal responses in the throat inhibited learning, and in the study by Forster (27), who found that to vocalize information was more effective than to write it. The writer is inclined to the view of Michael and Maccoby (88) that participation is a matter of practice. Under this view the increases in learning are interpreted as the product of repeated reinforcement. This disposes of participation as a multiple channel phenomenon, and places it in the realm of schedules and patterns of reinforcement where it will no longer concern us here.

[23] Abbott (1), Barlow (5), Forster (27), Frankfurther and Thiele (28), Hovland, Lumsdaine and Sheffield (51), Lumsdaine and Gladstone (81), Michael and Maccoby (88), O'Brien (100), and Seibert (113).

[24] Henmon (44), Kale (56), Pohlman (104), and Roshal (109).

IV. SYNTHESIS AND DISCUSSION

Learning from mass media capable of simultaneously producing an immense number of auditory and visual cues is an extremely complex process. What is perceived by an individual attending to a medium of communication is determined by the sensory limitations, prior associations and habits, attitudes and motives which he brings to the learning situation. The experimental models which are the bases of our conceptualization of the multiple channel learning process lack the richness of detail and the complexity of organization of real-life communication. The differences between model and reality make extrapolation of experimental results difficult.

Klapper (64) has pointed out that the experiment utilizes subjects highly motivated to attend to the presented communications. The typical listener, viewer, or reader of the mass media is not so motivated. His exposure to the medium is highly selective since many distractions compete for his attention. His interest must be aroused and maintained. He may ignore the compact and logical exposition suited for the motivated student, previously sensitized.

While the incongruities between model and reality must be kept in mind when extrapolation is required, they by no means negate the use of extrapolation. The experimental method is certainly the best if not the only way that new knowledge can be acquired. The assembled body of facts concerning learning under multiple channel conditions is really a special branch of the experimental literature on learning. It should have the same relation to education, advertising, training, and mental health information communicated through the mass media as does the general experi-

mental literature on learning to the applied areas as a whole. The model derived from experiments should contribute a point of view which is useful in the engineering of human communications. A proposed communication should have a certain lawfulness with respect to the best available model. As discrepancies arise between the model and the reality it describes, experiments must be designed to produce evidence which will permit the alteration or discarding of the model. This is the only way a science of communication can proceed.

The present model may be briefly recapitulated. Its channels of interest are the audio, print, and pictorial. Certain considerations have been added to this basic notion of channels for presenting information. The first consideration is the nature of the elicitation or testing of the learning resulting from the communication. The second consideration is the cognitive relations of the information simultaneously presented in the various channels. The third consideration is the type of learning desired or expected to result from the receipt of the information. The final consideration is the experimental requirement that the recipients of the communication must pay attention.

Generalizations

From the review of the experimental literature certain major generalizations appear valid:

1. Comparing the channels individually as conveyors of information: sufficient information exists for comparison of the audio and print channels, but not for comparisons involving the pictorial channel. It may be concluded that the print channel is more effective than the audio when the information to be presented is difficult or complex and the subjects are reasonably literate. The audio channel is a more efficient communicator than print when the subjects are illiterate, and in many specific instances when less difficult material is used. The audio channel is also considered more attention-demanding when interruption of attendance to visual stimuli is required, but under conditions of *continuous* simultaneous audio-print presentation of non-redundant information, neither channel has as yet a demonstrable advantage in gaining attention.

2. With regard to the relation between the presentation of a communication and the conditions under which the effectiveness of the communication is tested, the amount of demonstrable learning from the communication increases as the similarity between the testing conditions and the conditions of the original presentation increases. This conclusion may be predicted by extending the stimulus generalization concept of experimental learning theory. Another way of stating the generalization is that cues available when information is learned are of aid only if they are present when the information is tested. Applied to the multiple channel presentation, this generalization becomes: the learning of information presented in several channels is more likely to be demonstrated if it is tested on several channels. This generalization has been found useful both for discrimination and association learning.

3. Summation of cues, or facilitation —an increase of learning with increasing information provided by multiple channels—will take place under certain conditions: (a) when redundant information is presented simultaneously in print and audio channels, the facili-

tation of simultaneously hearing and reading a verbal message may be demonstrated in tests on either channel alone —a fact contradictory to the stimulus generalization hypothesis noted above. (b) when the additional cues are also present in the testing of the information (stimulus generalization); (c) when certain associations among information units are facilitated by a cognitive relationship such as the success of a verbal label in improving the learning of an ambiguous drawing. The conditions governing these facilitation relationships, however, are not presently understood.

4. Interference among information simultaneously presented by multiple channels may be expected when (a) the information in the various channels is unrelated and/or the cognitive difficulty or rate of presentation is such that successful alternation of attention among channels is not possible; (b) contradictory cognitive relationships exist among informational units in the various channels.

5. With regard to association learning, it is easier to associate an informational unit to a picture than to a meaningful word. The best available explanation of this is that meaningful words possess contradictory and extraneous associations which interfere with the new attachment.

6. Increases in learning from active vocal reproduction of information by the recipient, involving kinesthetic sensations, are demonstrable but are better explained as a practice rather than a channel effect.

V. Implications For Communicators

Research in the behavioral sciences has been much more successful in the doubts it has cast than in the truths it has averred. Assuming, for the moment, reasonable correspondence between the research model and reality, we may ask several questions concerning the validity of some of the current mass media uses of multiple channels.

A common practice among multiple channel communicators has been to fill the channels, especially the pictorial,, with as much information as possible. The obvious expectation is for additional communication to result from the additional information. However, the probability of interference resulting from the additional cues is very high. The hoped-for enhanced communication resulting from a summation of cues occurs only under special conditions. Most of the added cues in the mass media possess a large number of extraneous cognitive associations. The possibility that these associations will interfere with one another is probably greater than that they will facilitate learning.

If there is one principal unit of information that the communicator wishes to get across, every additional cue becomes a potential competitor which can interfere with the prime message. Even though the additional cues have been carefully related to the principal message by the communicator, the associations supplied by the recipients may negate all careful planning, and many of these associations are not presently predictable.

It may be argued that additional cues are excellent attention-gaining devices. So they are, if carefully handled. But a cue which has gained attention is likely to hold it. Too often the attention-getting device is allowed to continue in competition with the major message, or

the message is introduced simultaneously with the attention-getting device. Attention may be gained, but communication of the message may not result.

The greatest interference problem in televised communication probably arises from improper combination of the pictorial and audio channels. The reliance on the verbal audio channel to carry the core of the meaning is much heavier than is generally realized. The pictorial channel often merely illustrates or attracts attention. Unless careful coordination has been provided, there is a tendency to focus attention on the picture, while the significant message has been tucked away in the sound. This focusing of pictorial attention is usually a deliberate effort of the communicator on the assumption that the sound will take care of itself. But experimentation indicates that often sound does not take care of itself, particularly if it is continuous, and not an interjection. There seems to be no reason why the picture cannot be used to set up or emphasize the sound on occasion. A television commercial that began with an audio message and blank screen, instead of vice versa, might have startling effects.

There are several positive implications for the use of audio and pictorial channels which should be re-emphasized here. First, a pictorial message is pregnant with meaning but this meaning is often ambiguous and subject to personal interpretation. The use of words (printed and spoken) to structure this ambiguity and fixate attention is essential. The picture needs the word as often as the word needs the picture. Second, audio-print facilitation has strong experimental support, and the combined audio-print presentation of important information should receive wider application. It should be noted, however, that the current practice of exposing large amounts of print well ahead of the introduction of the audio channel puts the reader of the print well ahead of the audio voice; the facilitation effect, consequently, is lost. Third, the audio channel is much more capable of obtaining attention if it is used as an interjection on the pictorial channel rather than being continuously parallel with the pictorial.

A last comment concerning the assessment or testing of the effectiveness of the multiple channel media in producing learning is appropriate. In almost every instance, this assessment has taken the form of a single channel, usually print. The weight of the experimental evidence indicates that this form of testing does not measure an adequate amount of multiple channel learning, and may lead to erroneous results—particularly when the learning of pictorial information is tested by means of verbal descriptions approximate to it.

The purpose of this review is to weld the rather scattered literature on multiple channel learning into a single experimental model capable of generating further research hypotheses. If more questions have been raised than answered, this purpose has been achieved. The problem of interference, in particular, seems deserving of immediate attention, particularly interference from cognitive associations.

The writer has found those experiments performed under stringent laboratory conditions to be the most helpful in drawing conclusions, and it is in the laboratory that multiple channel research should proceed. Field studies provide necessary checks on the extrapolation of experimental findings, but

the lack of proper controls necessitates extreme caution in their interpretation. The present literature provides sufficient grounds for questioning some of the procedures currently practiced in the mass media. Research capable of evolving general principles for multiple channel communication should be possible in the near future.

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. . . *one word worth many pictures?*

Most of our interests center upon events, rather than upon things in static spatial relations. Causal connections, activities, time, and change are what we want most of all to conceive and communicate. And to this end pictures are poorly suited. We resort, therefore, to the more powerful, supple, and adaptable symbolism of language.

How are relations expressed in language? For the most part, they are not symbolized by other relations, as in pictures, but are *named*, just like substantives. We name two items, and place the name of a relation between; this means that the relation holds the two items together. 'Brutus killed Caesar' indicates that 'killing' holds between Brutus and Caesar. . . .

The trick of naming relations instead of illustrating them gives language a tremendous scope; one word can thus take care of a situation that would require a whole sheet of drawings to depict. Consider the sentence 'Your chance of winning is one among a thousand of losing.' Imagine a pictorial expression of this comparatively simple proposition! First, a symbol for 'you, winning'; another for 'you, losing', pictured a thousand times! Of course a thousand anythings would be far beyond clear apprehension on a basis of mere visual *Gestalt*.

From *Philosophy in a New Key*, by Susanne K. Langer. New York: The New American Library of World Literature, Inc. A Mentor Book, 1949. p. 59-60.

The Efficiency of Different Modes of Communication

Paul J. Deutschmann, Lionel C. Barrow, Jr., And Anita McMillan

This article is a progress report on a study comparing the effect of different modes of communication upon the relative learning of relevant and irrelevant information. It proposes that ordinary classroom instruction is less efficient than a mass communications counterpart because it screens out less irrelevant material. *The study was supported by a grant from Title VII, National Defense Education Act, to the Communications Research Center at Michigan State University and by the University's Applied Mechanics Department.* *Dr. Deutschmann is director of the Center and Mrs. McMillan is a research assistant there. Dr. Barrow, formerly an assistant professor at the Center, is now a project director for the Bureau of Advertising, ANPA. Dr. Charles O. Harris is head of the Applied Mechanics Department, and Professor Ralph L. Vanderslice was responsible for producing the films used in the study.*

THE SHANNON-WEAVER MODEL of the communication process (5) can be easily applied to the classroom or laboratory situation. The teacher can be equated with the communicator-encoder; the students with the decoder-receivers. The total complex of stimulation available to the receivers is the message plus noise. In most cases, this stimulation probably exceeds the receivers' capacity to decode.

That part of the stimulation—including lecture, audiovisual materials, and discussion—which is *relevant* to the instructor's purposes, we may designate as message. That part of the stimulation which is *irrelevant,* we may call noise: this includes not only literal noise inside and outside the classroom but also irrelevancies intermingled in the lecture or audiovisual aids. Frequently, some parts of the stimulation which appear to be message are, in fact, noise; *i.e.,* irrelevant to the communicator's purpose.

We do not ordinarily test for the learning of irrelevancies. Their effects, by and large, have usually been discov-

ered *post hoc* when the hypothesized learning of relevant material failed to occur.

For example, Kale and others (3) tested various filmed methods of teaching Russian words. They concluded, "The preponderance of evidence indicates that sound at worst interfered with learning, and at best did not enhance it. It may be conjectured that since the pronunciation of the words frequently was different than the way one would expect [them] to be pronounced (according to [their] spelling), this discrepancy makes learning to spell the words somewhat more difficult." Other studies summarized by Barrow (1) indicate that sometimes the added bits of realism—such as color, and hands shown tying a knot—may interfere with learning either by misdirecting the subject's attention to the wrong cue or by obscuring the correct one.

In testing for communication effectiveness, the researcher ordinarily only seeks evidence that the relevancies have been decoded. In this study, we are testing for the decoding of both the relevancies and the irrelevancies.

Film or TV versus Classroom or Lab

If in this light we compare teaching by film or television with classroom or laboratory instruction, some differences are apparent. The film or TV situation may be designed to screen out some of the irrelevancies present in the natural situation. Or, if it does not screen them out entirely, it may reduce their intensity.

For example, TV reproduction of a stimulus situation—classroom or lab—always loses a small amount of the original situation's detail. In many instances, the fine detail which is lost is part of the irrelevancies available in the natural situation. Film also is a means of focusing and/or reducing the intensity of irrelevancies. If a film version is shorter than a natural version, for example, the amount of irrelevant stimulation available will be reduced. While this reduction in a filmed counterpart of classroom instruction should be noticeable, it should be even more apparent in the counterpart of a laboratory situation, which seems manifestly richer in total stimulation—and particularly the irrelevant—for the student.

If we apply our general knowledge of the focusing ability of various means of educational communication, we can see differences among them. We list a set of these below, noting the degree of focusing, and offering estimates of their relative efficiency in terms of the proportions of relevant and irrelevant materials which they should deliver:

Table 1—Estimated Relative Channel Efficiency

Communication Situation	*Degree of Focusing*	*Rank Order of Channel Efficiency**
Natural laboratory	Minimal	4
Laboratory plus film	Some focusing	3
Film only	Sharp focusing	2
TV reproduction of film	Maximum focusing	1

*Compiled by subtracting the percent irrelevant correct from the percent relevant correct. Thus a rank of 1 would correspond to the highest positive score.

An opportunity to test these hypotheses arose in connection with a proposed evaluation of the effectiveness of a series of filmed versions of an applied mechanics laboratory.

The general purpose of the study is to compare student achievement (verbal and motor learning) in the traditional or natural laboratory with student achievement in three other settings: closed-circuit television, film only, and film in conjunction with a laboratory.

Pretest data were gathered on 118 subjects during the winter and spring quarters of 1960. During that time the films, tests, and testing procedures were revised. This report is concerned only with data gathered during the fall quarter of 1960 and the winter quarter of 1961. Only two settings were utilized in these experiments—the film only (or film condition) and the natural laboratory (or lab condition). The data for fall 1960 are based on a $n = 32$. Data for 37 subjects are included in the report for winter 1961.

In the fall experiment, verbal learning tests for relevant material were administered during six different laboratory sessions. Irrelevant tests were administered only in two sessions—the first and the sixth. In the winter experiment, relevant and irrelevant tests were administered during the first four sessions.

Data Gathering Procedures

The procedures were basically the same in each experiment. Since the laboratories were part of a regular course, students were permitted to choose the lab which best fitted their individual schedules. They were not assigned to conditions at random. The purpose of random assignment would have been to minimize group differences in variables correlated with those being measured. As a second best effort, a check was made on the students' grade point average (prior to their entering the course), and a numerical score on their college qualification tests. There was no significant difference between conditions with respect to either of these variables.

Students in the natural laboratory condition conducted an experiment during their two-hour period. They were then given a 20-minute quiz in a separate room—a necessary precaution since they could gain information about the irrelevant questions by looking about the laboratory. Students in the film condition viewed the film (20-35 minutes in length) at the beginning of the period, and were allowed to ask the instructor questions about it before taking their tests. Film subjects spent an average of one hour in the laboratory while lab subjects averaged close to two hours there.

Data Processing Procedures

The same criteria were used for both the irrelevant and the relevant test items. First, the items referred only to information *common* to both conditions. Second, an item analysis was performed. Only questions answered correctly by between 10 and 90 percent of the subjects, and which had an "r" (biserial) with total score of more than 40 percent were included in the final analysis. A relevant and an irrelevant percentage correct score was computed for each subject by dividing the number correct by the number of test items (relevant or irrelevant), and multiplying by 100.

In addition, a channel efficiency index was computed by subtracting the irrelevant percent correct from the relevant percent correct. This index has the following properties:

1. a range of $+100$ to -100
2. a positive sign when the relevant

percent correct is greater than the irrelevant percent correct; a negative sign when the reverse is true. The index is equal to zero when the relevant percent correct equals the irrelevant percent correct.

Data Analysis Procedures

Designed comparison procedures recommended by Snedecor (6), and a multivariate analogue of analysis of variance recommended by Greenhouse and Geisser (2) were used. The traditional 5 percent level was accepted as the dividing point between nonsignificant and significant results.

Hypotheses

1. The major hypothesis tested in each experiment was: subjects in the film only condition will obtain significantly higher channel efficiency scores than subjects in the natural laboratory condition. This hypothesis is based on the assumption that the mass media situation will provide proportionately more *focusing* upon the *relevant* items of the message, and less *focusing* upon the *irrelevant* items than does the natural laboratory situation.

Two subsidiary hypotheses were also tested. They were:

2. There will be *no* significant difference between film and lab groups in their scores on the *relevant* test items.

3. Subjects in the film condition will obtain significantly lower scores on the irrelevant test items than subjects in the lab condition.

Hypothesis 2 stems from the research comparing film or TV with traditional teaching methods. A summary of this research by Kumata (4) indicates that students learn as much in the film or TV condition as in the traditional classroom setting. Hypothesis 2 is based on the assumption that in this respect this study is no different from those Kumata reviewed.

Earlier we stated that (a) there are probably more irrelevant stimuli in the natural laboratory situation than in a mass media situation; (b) irrelevant stimuli are probably intensified to a

Table 2—Means and Analysis of Variance Results for Relevant Test Scores, Fall of 1960

	TESTS						
*Groups**	1	2	3	4	5	6	*Group Means*
Film Group A	79.625	68.750	69.750	28.625	49.875	57.125	58.958
Film Group B	70.500	69.375	61.625	33.875	53.500	48.500	56.229
Film A + B	75.063	69.063	65.688	31.250	51.688	52.813	57.5938
Lab Group C	56.000	69.375	35.000	35.750	57.000	50.000	50.520
Lab Group D	48.1250	80.000	42.750	43.000	73.125	44.250	55.208
Lab C + D	52.063	74.688	38.875	39.375	36.563	47.125	52.865
Test Means	63.562	71.875	52.281	35.312	58.375	49.968	55.229

Analysis of Variance Results

Source	*F*	*Significance Level*
Tests	13.57	.001
Film vs. Lab	1.11	n.s.
Interaction	2.52	.01

*Number of subjects per group = 8; number of groups = 4.

greater extent in the lab than in a mass media situation. Since we are dealing only with those irrelevancies *common* to both situations, Hypothesis 3 is based only on the intensification assumption.

The astute observer has probably noticed that the major hypothesis can be derived mathematically from Hypotheses 2 and 3 by simple subtraction. Hypothesis 1, however, is based on a separate assumption, and we feel that the relationship may hold even though our hypotheses about one or both of the components are untenable.

One additional control variable was inserted in the experiment of winter 1961. In order to check on the influence of the teacher, one instructor handled a film and a lab condition, while a second one handled an additional film section. The only hypothesis to be put forth is one of no significant difference.

Table 3—Means and Analysis of Variance Results for Relevant Test Scores, Winter of 1961

	TESTS					
Groups	1	2	3	4	*Group Means*	N
Film Group E	64.6	84.1	81.7	60.5	72.7	13
Film Group S	72.0	78.2	57.1	50.5	64.5	15
Film E + S	68.6	81.0	68.5	55.1	68.3	28
Lab Group E	58.9	71.4	45.4	69.7	61.4	9
Test Means	66.2	78.6	62.9	58.7	66.6	37

Analysis of Variance Results

Source	*F*	*Significance Level*
Tests	9.78	.001
Film vs. Lab	2.35	n.s.
Film Group: E vs. S	3.40	n.s.
Interaction	5.14	.001

Results: Relevant Test Scores

Tables 2 and 3 present the results for the tests of the learning of relevant verbal materials during the experiments of fall 1960 and winter 1961. The null hypothesis cannot be rejected. However, while there are no significant over-all differences attributable to the film *vs.* lab comparisons, in both experiments the groups-by-tests interaction term is significant. A check of the means indicates that while there are some sizable reversals, they tend to cancel each other, and result in the traditional finding of no significant difference.

Results: Irrelevant Test Scores

Irrelevant tests were administered during two sessions in the experiment of fall 1960 and during four sessions in the experiment of winter 1961. The predicted differences between the film and lab conditions were not found. However, in both experiments, the groups-by-tests interaction is significant.

Channel Efficiency Scores. Tables 6 and 7 show that, as predicted, the film groups obtained significantly higher channel efficiency scores than did the lab groups (significant at 1 percent both times).

Teacher's Influence. No significant differences were found between the film groups different instructors taught. (Tables 3, 5, and 7.) This variable was tested only in the winter 1961 experiment.

Table 4—Means and Analysis of Variance Results for Irrelevant Test Scores, Fall of 1960

	TESTS		
*Groups**	1	6	*Group Totals*
Film Group A	37.2500	41.0000	39.1250
Film Group B	47.1250	50.1250	48.6250
Film A + B	42.1875	45.5625	43.8750
Lab Group C	31.7500	57.0000	44.3750
Lab Group D	40.0000	74.8750	57.4375
Lab C + D	35.8750	65.9375	50.9062
Test Totals	39.0312	55.7500	47.3906

Analysis of Variance Results

Source	*F*	*Significance Level*
Tests	16.29	.001
Film vs. Lab	2.42	n.s.
Interaction	3.68	.05

*Number of subjects per group = 8; number of groups = 4.

Table 5—Means and Analysis of Variance for Irrelevant Test Scores, Winter of 1961

	TESTS					
Groups	1	2	3	4	*Group Means*	*n*
Film Group E	33.9	61.5	46.2	75.2	54.2	13
Film Group S	32.7	56.1	56.0	77.8	55.7	15
Film E + S	33.3	58.6	51.4	76.6	55.0	28
Lab Group E	57.1	41.3	68.9	76.7	61.0	9
Test Means	39.1	54.4	55.7	76.6	56.4	37

Analysis of Variance Results

Source	*F*	*Significance Level*
Tests	28.15	.001
Film vs. Lab	2.59	n.s.
Film Group: E vs. S	.17	n.s.
Interaction	4.19	.01

Table 6—Means and Analysis of Variance Results for Channel Efficiency Scores, Fall of 1960

	TESTS		
*Groups**	1	6	*Group Totals*
Film Group A	42.3750	16.1250	29.2500
Film Group B	23.3750	—1.6250	10.8750
Film A + B	35.1250	7.2500	20.0625
Lab Group C	24.2500	—7.0000	8.6250
Lab Group D	8.1250	—30.6250	—11.2500
Lab C + D	16.1875	—18.8125	—2.6250
Test Totals	24.5312	—5.7812	9.3750

Analysis of Variance Results

Source	*F*	*Significance Level*
Tests	78.83	.001
Film vs. Lab	10.88	.01
Interaction	0.84	n.s.

*Number of subjects per group = 8; number of groups = 4.

Table 7—Means and Analysis of Variance Results for Channel Efficiency Scores, Winter of 1961

	TESTS					
Groups	1	2	3	4	*Group Means*	*n*
Film Group E	23.44	37.69	37.92	—14.77	19.27	13
Film Group S	42.60	45.60	0.47	—18.20	17.62	15
Film E + S	30.36	41.93	17.86	—16.61	18.38	28
Lab Group E	1.78	30.11	—23.44	—6.11	00.58	9
Test Means	23.41	39.05	7.81	—14.05	14.05	37

Analysis of Variance Results

Source	*F*	*Significance Level*
Tests	30.52	.001
Film vs. Lab	8.06	.01
Film Group: E vs. S	.07	n.s.
Interaction	6.77	.001

Discussion

The above results are in line with, but do not completely support, the major hypothesis. Our statistical test of Hypothesis 1 indicates that it can be accepted. However, Hypothesis 1 is mathematically derivable from Hypotheses 2 and 3. To have full confidence in our major finding, we must be able to infer the acceptability of the subsidiary

hypotheses. This cannot be done.

On the other hand, the key dependent variable is the *interrelationship* between the measures of two kinds of learning—relevant and irrelevant. We may have—and, in fact, do have—considerable variation in the levels of both kinds of learning from test to test. Yet despite this variation, we have a highly consistent relationship. In only one instance (session 4, winter 1961) does the *lab* group obtain a higher index score than the *film* group. In all others, the direction of the scores is as predicted. This situation is, in many senses, comparable to the problem of interpreting the sub-parts of any test. For example, it is well known that the reliability of most intelligence tests is considerably higher than the reliability of any one of the sub-parts that make up the test.

Conclusions as to Two Modes

This is a report of a study designed to test the effectiveness of different communication situations. We have defined *effective* as the discrepancy between the amount of relevant information learned by students in a given situation and the amount of irrelevant information learned by the same students. The most effective situation in our view would be the one in which students learn all of the relevant material and none of the irrelevant material; the least effective would be the one in which students learn none of the relevant material and all of the irrelevant. Of course, we did not expect—or find—that any of the situations tested would reach either of these extremes.

In our original formulation we made the following prediction about the effectiveness of four communication situations:

Communication Situations	*Rank Order**
Natural Laboratory	4
Laboratory + film	3
Film only	2
Television reproduction of film (TV)	1

*1 = most effective

In this report we presented data on the relationship of only two of these conditions: film vs. natural laboratory. These data partially confirm our hypothesis. The channel effectiveness index scores were in the predicted direction (film more effective than lab), but we obtained inconsistent results on the tests of related hypotheses.

Future research efforts will be aimed at testing the effectiveness of all four conditions.

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Measurement Of Television Utilization

Loran C. Twyford, Jr.
And Leo D. Doherty

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TELEVISION UTILIZATION in education is normally evaluated in terms of effectiveness and number of viewers. If learning can be shown to be substantially improved by televised instruction, and if the programs are viewed by a sufficiently large group, the utilization is deemed good.

Effectiveness of Television

Allen (1) and Kumata (2) have reviewed the studies concerned with the effectiveness of television. Their surveys indicate that learning is usually as great from television as from regular instruction, and may be significantly greater in some cases. Evaluation of learning in the National Program in the Use of Television in the Public Schools disclosed significant differences in favor of television in 40 comparisons, and in favor of control groups in 12 comparisons (3). The amount of increased learning through televised instruction is seldom more than 15 percent, and an over-all estimate would probably put the increased effectiveness at less than 10 percent.

Because of this relatively small increase in learning, television installations have begun to cite the number of viewers to justify the relatively sizable funds required to operate a television station or a closed-circuit installation (4).

Measurement of Audience Size

Television audience size is a meaningless concept unless it is related to the duration and size of other educational audiences, and this in turn relates to the relative cost of providing such instruction. To make the comparison, both kinds of audiences must be measured in similar terms.

Some of the difficulties of measuring audience size arise from the different patterns of television utilization. It has become customary for a television station to ask school personnel to indicate

the number of classes watching their programs. Some schools use television as they used films in the thirties: every class is rotated into a viewing room periodically, but none watches each program in a series. Even when a class does watch a televised series, the viewing may be intermittent, or more extensive at the beginning of the year than later on. These factors may produce inflated utilization figures. In many cases this inflation occurs through the dubious practice of multiplying the number of classes by the number of class sessions a week—even though the same viewers watch each day—to calculate the size of the viewing audience. Such figures are meaningless. In a few other cases some additional factor may be added to account for adult audiences, private school viewers, and out-of-state viewers. All these considerations make audience figures difficult, if not impossible, to interpret.

Audience Measurement Technique

To cope with the problems associated with audience assessment, a special procedure was developed and employed in New York State prior to extensive expansion of television activities there. Since the pending legislation for this expansion dealt with aid to public schools, the audience measurement was restricted to those schools. To prevent any possibility that schools might augment their normal viewing audience, only the experimenters knew in advance what date had been selected for evaluation. All school principals were sent a form on December 7, 1960 requesting that teachers supply the names of the programs viewed that day, their source, and the number of viewers. That date was selected to be somewhat representative of the entire year's viewing, since many schools sample the programs in October but later drop them, while others drop them toward the end of the year if the programs become too difficult or too easy for their pupils. Principals were also asked to indicate the number of television sets and the average daily attendance. A month later, follow-up letters were sent to principals who had not responded. Telephone interviews were undertaken to check on the interpretation of the form made by individual schools. The various factors which might have caused inflated results were matched and equated against those that may have been deflating. The final results obtained were felt to be reasonably accurate.

Audience figures were restricted to a single day to encourage accuracy. From program schedules, Wednesday (which fell on December 7) was selected as a representative day of the week. Television station directors supplied information concerning annual operating costs, weekly program schedules, and programs telecast that Wednesday.

Audience Measurement Example

Table 1 lists the number of viewers who watched educational television programs in New York State on December 7, 1960. Since a student may watch more than one program on a single day, the fourth column which lists the average number of viewers per program is more exact. This figure averages out the wide differences in viewing of individual programs. The number of viewers becomes more meaningful when related to the school population within a 50 mile radius of the transmitter (as listed in the fifth column). The last column indicates what percentage of this school popula-

TABLE 1—PERCENT OF PUBLIC SCHOOL ENROLLMENT VIEWING TELECAST PROGRAMS* ON A GIVEN DAY

Station	*Program viewers Dec. 7, 1960*	*Programs Dec. 7, 1960*	*Average viewers per program*	*Area school population*	*Percent school population viewing each program*
		Open Circuit			
Regents Project NYC	82,880	13	6,375	1,515,061	.42
WNED-Buffalo	8,845	11	804	266,591	.30
Mohawk-Hudson	3,432	2	1,716	180,960	.95
Rochester	1,945	1	1,945	182,013	1.07
Watertown	840	2	420	66,346	.63
Syracuse	110 (Adult)	1	110	223,684	.05
		Closed Circuit			
Regents Project Cortland	2,221	11	202	4,158	4.8
Chelsea—NYC	480	2	240	625	38.0
Corning	745	4	186	8,091	2.3
Plainedge	120	1	120	2,071	5.8
Centereach	360	1	360	743	48.5
Elmira (Beecher School)**	270	5	54	600	9.0
White Plains	120	4	30	2,200	1.4
Baldwin (Dept. Eqpt. Loan)	240	2	120	1,655	7.3
Spring Valley (Dept. Eqpt. Loan)	825	7	118	825	14.3
Olean (kinescopes)	800	7	114	2,333	4.9

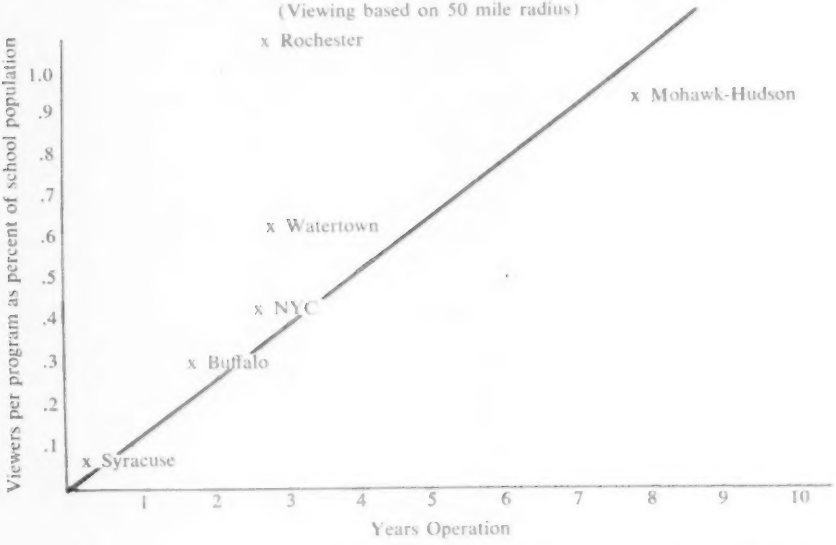
*Thirty-one other schools used kinescopes that day.
**Nine similar systems in New York City, Great Neck, Bay Shore, Plainview and Smith town were not in operation that day.

tion was viewing each program: in most cases it was less than 1 percent. The lower half of Table 1 gives the same kind of data for closed-circuit installations with respect to the school population for the area served. This survey does not include a number of college television installations, nor does it cover the 31 schools that were using kinescope recordings on the survey date. It was not possible to include the nine, small closed-circuit television installations then being established in New York City, Great Neck, Bay Shore, Plainview, and Smithtown. The installations cited in this report are listed in decreasing order of operating expenses and size of installation. It should be noted that the Syracuse installation employs a commercial channel, and the programs are beamed to an adult audience rather than to a regular school audience. The survey does not include utilization by private schools, pupils in neighboring states, and adult audiences.

The longest period of continuous educational telecasting was carried out by the Mohawk-Hudson Television Council serving the Albany-Schenectady-Troy area. A theoretical curve shown in Table 2 can be fitted through those points representing the largest number of programs and the most years of operation. It is reasonable to expect that after three years approximately .4 percent of the school population within a radius of 50 miles of the television station will be watching any program that is put on the air. It is also probably safe to assume that even after a period of eight years not more than 1 percent of the school population will be watching the average program unless special viewing conditions are obtained. The ultra-high fre-

TABLE 2—TELEVISION VIEWING AND YEARS OF OPERATION

(Viewing based on 50 mile radius)



Station	*Percent population viewing*	*Years telecasting*
Regents—NYC	.42	2.5
WNED Buffalo	.30	1.5
Mohawk-Hudson	.95	7.5
Rochester	1.07	2.0
Watertown	.63	1.8
Syracuse	.05 (adult)	.2

quency educational station in Buffalo appears to have utilization consistent with the pattern of growth expected. Using these figures one may estimate the number of viewers—anywhere in the state or within a given area—who may be watching a broadcast television program.

Chart No. 1 gives some insight into the degree of increased utilization that might be expected if more television sets were available. These figures were obtained from elementary schools in the viewing area of the Regents Educational Television Project in New York City. They indicate that a 50 percent increase in viewing occurs when schools obtain a second television set. A 7 percent increase occurs for a third set, and an additional 5 percent for the fourth. Sets in excess of two are probably used in individual classrooms under better conditions for learning. Since nearly all New York City schools have two television receivers per school, no large increase in the amount of utilization could be expected from additional receivers, although the quality of utilization would probably improve.

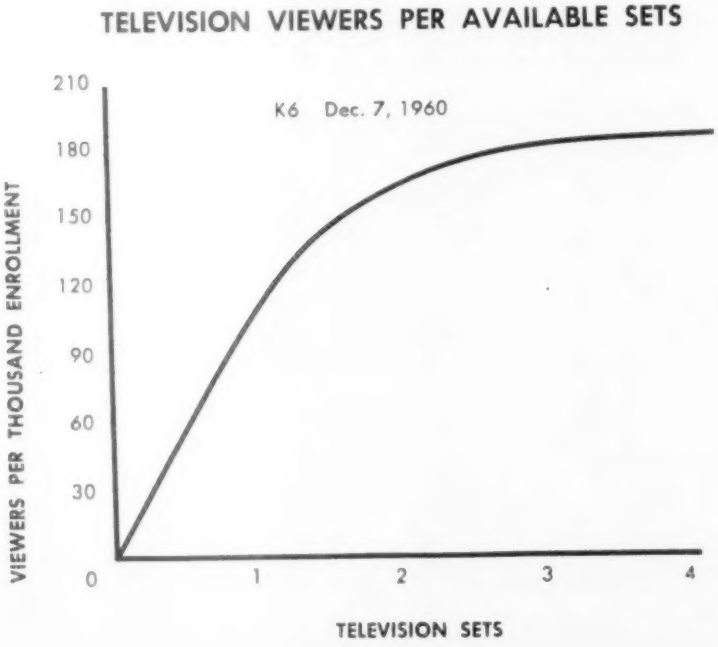
Determination of Instructional Value

After any instructional innovation has been in effect for some time, the question is inevitably asked, "Is this innovation worth the cost?" The answer must take into consideration its value in providing

improved quality or additional instruction. For the sake of this study, it was conservatively estimated that television instruction is only as effective as regular instruction. If it is more effective, the results obtained would be improved by 10 or 20 percent.

Television utilization figures have meaning only when they are compared with the amount of additional instruction that might be obtained if the money spent on television operations were spent in a normal manner for providing the additional instruction. In other words, if the money spent on operating a television station were used to provide regular instruction, how many students could be taught full-time as compared with the number that could be taught full-time by television? In Table 3 such a comparison is made for all open- and closed-circuit television installations in New York State's public schools. The second column indicates the yearly operating costs of the installations in providing programs for public education. The estimated cost of teaching one student for the year 1960 is $522. The third column shows how many students could be taught for money employed to operate the television installations. The fourth column indicates how many full-time students are actually being given television instruction after correction for the number of hours of television originating each day. (For this tally, see Table 4.)

Chart 1



The instruction factor listed in the last column of Table 3 indicates how many times as much instruction is being provided by television as could have been provided if the money had been expended for supplementary teaching such as art, music, or science. In all cases, television provided more instruction than would have been provided if the television expenditure had been made for other educational instruction. It should be noted that the Regent's Educational Television Project in New York City provides nine times as much instruction as might otherwise be provided at the same cost. In the least expensive closed-circuit installation, practically no yearly operating expense is involved although it is difficult to arrive at exact figures. For this reason, it may be difficult to interpret the high instructional factor obtained for these installations. The figures given for the instructional factor indicates that television money is, in general, being expended wisely—or at least efficiently—in providing instruction.

Potential Television Stations

Using the figures obtained in Chart 2 concerning the population that will be viewing a television station after a three year period, we can make some predictions concerning potential television installations.

In the New York City area, with a school population of a million and one-half, the cost to teach .4 percent of the school population is approximately $3,000,000. This represents a comparative value of televised instruction in the New York City area after three years of operation. Since normal operating expense for a television station is approximately $300,000 a year, it is possible for 10 stations to operate in the New York City area and still provide instruc-

TABLE 3—RATIO OF STUDENTS TAUGHT BY TELEVISION TO THE NUMBER THAT COULD BE TAUGHT BY CONVENTIONAL MEANS

Station	*Yearly public education operating cost*	*Students that could be taught for $522*	*Equivalent TV audience*	*Instructional factor*
	Open Circuit			
Regents Project NYC	$400,000	766	6,885	9.0
WNED-Buffalo	137,000	262	563	2.2
Mohawk-Hudson	50,000	98	172	1.8
Rochester	50,500	97	156	1.6
Watertown	12,000	23	84	3.6
Syracuse	1,400	2.7	11 (Adult)	4.1
	Closed Circuit			
Regents Project Cortland	$100,000	191	224	1.2
Chelsea-NYC	35,000	67	72	1.1
Corning	35,000	67	71	1.1
Plainedge	500	1	12	12.0
Centereach	9,400	18	72	4.0
Elmira	0	0	31	Infinite
White Plains	200	.4	4.5	11.2
Baldwin	0	0	37	Infinite
Spring Valley	0	0	14	Infinite
Olean	300	.6	48	80

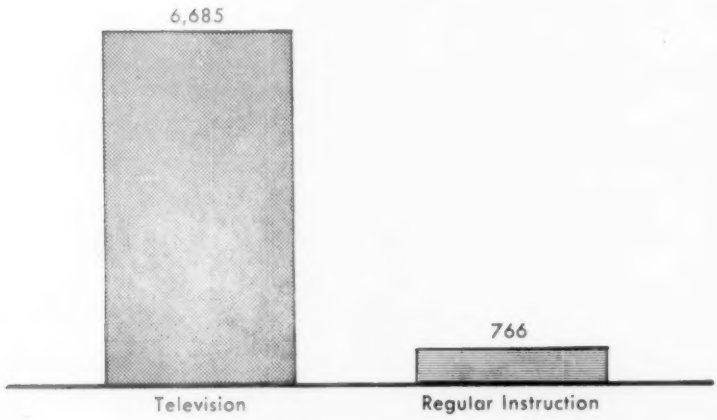
TABLE 4—PROJECTION OF PER PROGRAM VIEWING DATA

Station	*Broadcast hrs./week*	*Average hrs./day*	*Part of 5 hour instructional day*	*Viewers /program*	*Equivalent TV audience*
		Open Circuit			
Regents Project NYC	27	5.4	1.08	6,375	6,885
WNED-Buffalo	17.5	3.5	.70	804	563
Mohawk-Hudson	2.5	.5	.1	1,716	172
Rochester	2.0	.4	.08	1,945	156
Watertown	5.0	1.0	.2	420	84
Syracuse	2.5	.5	.1	110	11
		Closed Circuit			
Regents Project Cortland	27.7	5.54	1.11	202	224
Chelsea-NYC—PS33	7.5	1.5	.3	240	72
Corning	9.55	1.91	.38	186	71
Plainedge	2.5	.5	.1	120	12
Centereach	5.0	1.0	.2	360	72
Elmira	12.5	2.9	.58	54	31
White Plains	3.75	.75	.15	30	4.5
Baldwin	—	1.6	.31	120	37
Spring Valley	3	.6	.12	118	14
Olean	10.5	2.1	.42	114	48

Chart 2

STUDENT INSTRUCTION
TELEVISION VS. REGULAR INSTRUCTION

Regents Education Television—New York City
Operating Cost—$400,000



NO. OF FULL TIME STUDENTS TAUGHT

tion as efficiently as it might be provided by other means. For this conclusion it must be assumed that learning via television is at least as good as it might be by other means. When the finding for this metropolitan area is projected to other areas of the state, it would seem, in general, that one or two stations for each area might be justified. Since it is possible to operate a television station using kinescope recordings, donated time, and donated facilities for less than $300,000 a year, it may be possible to locate more than one station in some areas. The areas listed in Table 5 are not definitive since any area in the state with an adequate school population should be able to justify a television station of some kind if operating costs are limited.

TABLE 5—POTENTIAL TELEVISION STATIONS

Assuming:

1. $300,000 per year operating expense
2. .4 percent of school population viewing (3 year normal)
3. 50 mile viewing radius
4. Equivalent instruction value by TV as from regular instruction.

Area	*School population*	*Cost to teach .4% of school population*	*Number of $300,000 stations*
N. Y. C. Area	1,515,061	$3,163,528	10.5
Buffalo	266,591	556,660	1.85
Syracuse	223,684	467,085	1.56
Rochester	182,013	380,016	1.26
Albany	180,960	377,928	1.26
Watertown	66,346	138,330	.46

TABLE 6—COSTS PER PUPIL OF TELEVISION PROGRAMS*

Station	*Yearly operating cost*	*Yearly program viewers (176 days)*	*Cost per program per viewer*
	Open Circuit		
Regents Project NYC	$400,000	14,586,880	2.7 cents
WNED-Buffalo	137,000	1,556,720	8.8 cents
Mohawk-Hudson	50,000	604,032	8.3 cents
Rochester	50,500	342,320	14.6 cents
Watertown	12,000	147,840	8.1 cents
Syracuse	1,400 (adult ed.)	19,360	7.2 cents
	Closed Circuit		
Regents Project Cortland	$100,000	390,896	26 cents
Chelsea-NYC	35,000	84,480	41 cents
Corning	35,000	131,120	42 cents
Plainedge	500	21,120	2.4 cents
Centereach	9,200	63,360	15 cents
Elmira	0	47,520	0 cents
White Plains	200	21,120	.94 cents
Baldwin	0	42,240	0 cents
Spring Valley	0	145,200	0 cents
Olean (kinescopes)	300	140,800	.21 cents

*Note: Regular instructional costs are $.50 per pupil per lesson.

Costs Per Pupil

Table 6 indicates the yearly operating costs and the yearly audience for each installation. The third column lists the costs of providing a program for each viewer. For the Regents Educational television Project, New York City, the cost per viewer of a program is 2.7 cents, or approximately $1.00 for one class. Several of the large closed-circuit installations cost up to 42 cents per viewer, but several of the small closed-circuit television systems operate at negligible cost. For kinescope recordings where the only expense to the school is return postage, the cost is approximately 1/5 of a cent per viewer.

It will be noted that none of these costs is more than the cost of providing a teacher in the classroom: 50 cents per lesson per pupil.

Summary

Measurement of effectiveness and the extent of use are the two principal means of assessing television utilization. Television programs are generally as effective or slightly more effective than regular instruction. The value of increased utilization of television programs has been difficult to assess because of the difficulties of measuring audiences and giving meaning to the values obtained.

A proposed audience measurement technique was developed and applied to television installations in New York State. On December 7, 1960, all schools in the State reported on the television programs that they watched on that date. Tables in this article presented utilization figures for all television broadcast programs and closed-circuit installations and for one kinescope utilization activity.

Conclusion

1. Television utilization increased with the length of time an installation had been inoperation; the rate increase was approximately .1 percent per year. In analysis it was assumed that the viewing audience after three years would amount to .4 percent of the public school enrollment within a 50 mile radius of the station.

2. All television installations operated to provide more instruction in terms of pupil coverage than might have been provided if the money had been expended in any other manner to provide supplementary instruction, and a number of installations provided as much as nine times more instruction.

3. The smaller closed-circuit installations which require little or no operating expense, and kinescope recordings used in the classroom appear to be very efficient means of providing television programs.

4. The major population centers were found able to support one or two educational stations at the present rate of utilization. The New York City area can support up to ten stations.

5. Smaller cities throughout the state should take advantage of kinescope recordings to provide programs, use donated facilities, and study other methods for providing lower cost transmission of television programs.

6. In all cases, the cost of providing television programs was less than the cost of regular instruction.

7. Programs telecast by the Regents Educational Television Project in New York City cost less than 3 cents per viewer per program.

8. The over-all findings support the view that educational television should be expanded.

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. . . *collaboration and communication*

Philosophers had a great deal to do with the categories and approaches that were taken up when communication theory began to come into its own. American philosophers did, in fact, foster the growth of academic preoccupation with the analysis of informed public opinion. Recall . . . John Dewey's *Public and Its Problems*. . . .

The contributions of philosophy to communication theory are becoming more, rather than less, profound as specialists in the rapidly growing discipline of communications studies become more capable of passing to and fro between theory and observation. . . . The roots go back at least to Charles S. Pierce and run through A. N. Whitehead and Bertrand Russell, Rudolf Carnap . . . to J. C. C. McKinsey and his colleagues.

The mansions of philosophy also include an armory of devices for exploring the more subtle nuances of communication; their potential, indeed, has not yet been tapped. I refer to the comprehensive orientation of Ernst Cassirer, for instance, and of such creative devotees as Susanne Langer in aesthetics. . . .

All *interaction* among living forms is a complex and variable process of *collaboration* and *communication*. Hence all the value outcomes sought through the diversified institutional forms of society are specialized in various degree to communicating and collaborating. Economic outcomes subordinate communication to wealth; political outcomes subordinate communication to power; and so on through the value outcomes. Only one of the value-institution processes is distinctly preoccupied with an outcome that culminates to an exceptional degree in the exchange of communications. We refer . . . to the institutions of individual and collective *enlightenment*. It is appropriate that part of the university community distinctly concerned with enlightenment should become a focal center of study and inspiration to studies that continue to open up the new world of communication knowledge.

From "Communications as an Emerging Discipline." Harold D. Lasswell. *AV Communication Review*, Vol. 6, No. 4, 1958, p. 251-4.

ETV IN AND OUT OF SCHOOL

THE IMPACT OF EDUCATIONAL TELEVISION, edited by Wilbur Schramm (Urbana: University of Illinois Press, 1960. 247 p. $5.00).

This book contains a collection of reports of research sponsored by the National Educational Television and Radio Center. It is divided into four general areas: (a) "Educational Television in the Community," (b) "Educational Television in the Classroom," (c) "Educational Television and Children," and (d) "A Proposed Theory for the Effect of Educational Television."

One of the reports dealing with "Educational Television in the Community" is a compilation taken from the program logs of thirty educational television stations in 1959. Another synthesizes reports of audience surveys done during the same period. The program data are analyzed by source, intended audience, form and content, and by station classification—community, university, school and network. The audience surveys are reported in terms of audience size, educational level, social class, public participation, and the use of other media. These two reports will provide useful summaries for anyone interested in the consumer and the products of educational television, *circa* 1959.

One of the purposes of a paper by Geiger and Sokol in the first section is to suggest an apparent attitudinal conflict set up by educational television, and to explore some of its implications. They hypothesize that resistance to ETV arises from the incompatability resulting from the use of the same media for two quite different culturally valued goals, recreation and education. They argue that people use television either for education or for recreation, but not for both. If their hypothesis is correct, it would seem to follow that ETV must continue to provide highly "educational" programs for an audience that will continue to be small, or to popularize its programs in order to draw a larger audience seeking to be entertained. The latter alternative would, they imply, alienate the audience seeking to be educated. While their data show a small negative relationship between watching television for recreation and watching for entertainment, they do not in general suport the hypothesis, and it has already been vigorously questioned by E. B. Parker ("Increasing the Audience for Educational Television," *AV Communication Review* 9:99-108, March-April 1961). In any event, the controversy that this hypothesis will create should eddy for some time about theories of programing educational television stations.

The section on "Educational Television in the Classroom" is rather weak in that with only one exception, the studies included represent only a very small—and not especially significant—sample of this much researched area. The exception is Professor Kumata's review and synthesis of research on instructional television from 1956 to 1959, which thus brings up to date his earlier comprehensive review of the literature. Such reviews are extremely valuable, and it may be hoped that they will continue.

One of the articles in the section on "Educational Television and Children" is "A Note on Children's Use of Television." It provides information relevant to the present controversy on the effect of television on children. Essentially, it is a preview of a book now available by W. Schramm, J. Lyle, and E. B. Parker, *Television in the Lives of Our Children* (*AVCR*, 9:214-16, July-August 1961). No mention is made of the other outstanding book on the effect of television on the young, by Hilda T. Himmelweit, A. N. Oppenheim, and Pamela Vince, *Television and the Child* (Oxford University Press, 1958).

Finally, there is a "Proposed Theory for the Effect of Educational Television," developed by Barrow. Starting from the theory that communications effectiveness depends upon coping with interferences that distract attention and interferences which mask the message, he suggests a series of hypotheses concerning the interrelationship of such variables as comprehensibility, potency, semantic level, message density, and span of attention. He then goes to the research literature—film research primarily—for evidence to support or refute his hypotheses. It did not seem to this reviewer that he was very successful in finding support for his hypotheses in the existing literature. Nevertheless, Borrow's proposed theory should provide a fertile field for the student seeking a framework within which to cast his research.

The reader will find much useful information in this book and a number of intriguing ideas. Its principal defect as a general review is in its omissions. These are certain to occur, however, when sponsorship as well as research quality and relevance is a criterion for inclusion. —CHARLES MACINTYRE
University of Illinois

VIEWING OF CRIME

TELEVISION CRIME-DRAMA: ITS IMPACT ON CHILDREN AND ADOLESCENTS, by R. J. Thompson (Melbourne: F. W. Cheshire, for the Department of Audio-Visual Aids, University of Melbourne, 1959. 197 p. 25s.).

There are, roughly speaking, two basic research designs for the study of the effects of the mass media. The first may be called the field design applied after the fact. The second is the experimental design where the attempt is to subject hyopthesized variables to systematic control. The first is exemplified by Cantril's study of the impact of the *Invasion from Mars* radio broadcast, and Merton's analysis of the Kate Smith bond-selling campaign on radio as reported in his *Mass Persuasion*. The study under review is an example of the second.

It must be admitted that the field-after-the-fact type of investigation has yielded more significant insights into the *social dynamics of impact* than the meticulously controlled experimental study with its manipulation of variables and refined statistical analyses.

The problem of designing this latter type of research bristles with technical difficulties—a fact which in part accounts for its paucity. These difficulties are of two sorts: the extremely complex character of the stimulus material which must be the source of the hypothesized variables, and the subtly inter-related factors which condition the impact on the audience. This is particularly true when the stimulus material has a dramatic format. Such material is intrinsically and necessarily ambiguous as to its "message." All this makes the construction of test instruments which will throw light on meaningful hypotheses a perplexing problem.

The investigators in the present research appear to have been aware of these difficulties. The results, while not exactly earth-shaking, add significantly to the small fund of knowledge in this field.

The study was sponsored by the University of Melbourne's Department of Audio-Visual Aids, and is the second in a series. The results are based on a sample of 48 intermediate and high school students from two Melbourne schools drawn from a larger sample of 192 students. These students viewed TV productions of two half-hour crime dramas which featured tension, violence, and sex, and a one-hour tragic drama which did not feature sex or violence.

The subjects were given an entertainment quiz to discover their entertainment preferences and frequency of exposure to TV and films, a film comprehension test based on the dramas they had watched, and a projective-type "imaginative reactions" test. The last was administered before and after TV exposure. During the showing of the program, a number of ultra-violet photographs of the viewers were taken.

The factorial analysis design to which the data were subjected required four dimensions: the dynamic and moral aspirations of the female protagonist, the "buoyancy level" (mood based on the expectation of a happy outcome), and the film comprehension test scores. The factors were type of film (crime or tragic), pre- and post-film exposure, frequency of TV viewing, sex, and school.

Some of the more significant changes as a result of viewing are: women are seen as planning less and playing a more passive role in life (dynamic aspiration dimension); they are seen as morally higher, more "idealistic" (moral aspiration dimension). The expectancy of a happy outcome drops markedly (buoyancy dimension). The most important factor contributing to these results was the TV exposure itself, although frequency of TV viewing contributed significantly to the dynamic and moral aspiration dimensions. Boys were found to be less sensitive than girls on both the dynamic and moral dimensions.

The author generalizes these results as follows: The projective tests indicate a fall-off in buoyancy of mood, and greater caution and conventionality. High frequency of TV viewing tends to lower susceptibility to stress effects of viewing. It is suggested that some sort of built-in mechanism protects the adolescent viewers from stress. No evidence supported the notion that viewing crime drama provoked criminal or psychopathic tendencies. Analysis of the ultra-violet pictures taken during the viewing did not appear to yield definitive results —largely because of the lack of rigorous techniques for scoring facial expressions.

These results are solidly based and are certainly suggestive, but one cannot escape the impression that they are scarcely proportionate to the amount of

effort required to design and carry out the research. It was a carefully planned investigation with apparently full recognition of the difficulties involved, but as in most investigations of this type, the methodological focus is inescapably on immediate, measurable effects. The present report suffers from a certain lack of clarity in organization and presentation of results. The book would have greatly benefited from an analytical index. There is, however, an excellent bibliography of over 300 titles.

—FRANKLIN FEARING

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Los Angeles

NOTHING COMPARABLE

THE EFFECTS OF MASS COMMUNICATION, by Joseph T. Klapper (Glencoe: The Free Press, 1960. 302 p. $5).

In the words of its author, this book is an attempt "to collate and integrate the findings of published research, and some provocative conjecture, regarding certain social and psychological effects of mass communication."

The central idea around which the book is woven is expressed in the first of the five "emerging generalizations": "Mass communication *ordinarily* does not serve as a necessary and sufficient cause of audience effects, but rather functions among and through a nexus of mediating factors and influences." The remaining four generalizations explicate the first and cite exceptions to it.

Within the limits of the "certain social and psychological effects," the nature of the research summarized, and the range of "provocative conjecture" on the effects of mass communication, the author has succeeded in producing a comprehensive, painstaking, and insightful book. It will be useful to all interested readers and completely satisfactory to none.

The book consists of (1) an explanatory preface and an introductory chapter setting forth five "emerging generalizations" which serve as organizing principles of mass communication effects and the factors involved; (2) three chapters dealing with the role of mass communication in reinforcing opinion, creating opinion on new issues, and converting people from one opinion to another; (3) a single chapter on contributory aspects of "the communication" and "the communication situation"; (4) a series of chapters on specific media effects including crime and violence, escape, adult TV fare and child reactions, and media attendance and audience passivity; and (5) a concluding note which points out what the author considers to be the virtues, shortcomings, and error proneness of the five "emerging generalizations."

A bibliography of over 270 references, a set of chapter notes, and an excellent index help to increase the usefulness of the book.

As one who has participated in the collation and integration of research literature in one area of mass media usage, this reviewer is well aware of the monumental difficulties involved in such an effort and the risks that attend the imposition of ordering propositions and concepts on a mass of data that are frequently contradictory, and rarely conclusive. The wonder of this book is that the author triumphed over so many of these difficulties.

Throughout the book, Klapper is at the mercy of the inconclusiveness, the imperfections of research design, and the idiosyncracies of problem formula-

tion of the research collated and integrated. This leads to an insistent qualification of conclusions from the research, and the formulation of generalizations which "organize" the research data by specifying the alternatives and contingencies of effects. Obviously, such a set of generalizations is likely to "account for" all research findings on effects and their determinants.

This reviewer had hoped for a treatment of mass communication in terms of a more explicit and interacting nodular model of the system of mass communication. Had the system concept been employed, it would have been possible to simplify the proliferating complexity of factors introduced by the author into mass communication, rather than to organize this complexity while preserving its proliferation.

Many readers will be surprised that Cantril's classic study of *The Invasion from Mars* is completely omitted from this book, that little consideration is given to adult audience motivations and satisfactions in media exposure other than those associated with soap operas, comics, and the like, and that the rich literature of research in the use of new media in education is ignored on the questionable assumption that its results are rarely generalizable beyond the pedagogy of instruction.

Yet none of these presumed shortcomings overshadow the fact that Klapper has performed a great service in the difficult task of (1) collating and integrating a chunk of the research literature on the effects of mass communication and the dynamics of the process, (2) introducing intellectual order into the widespread and conflicting research and conjecture on mass communication effects, and (3) formulating a tentative set of generalizations which take into account alternative effects and specify that mediating factors or influences operate in the process.

Nothing comparable to this book has been published. The need for it has been painfully evident. —CHARLES F. HOBAN
University of Pennsylvania

MT—FAD OR PHILOSOPHY?

AUTOMATIC TRANSLATION, by D. Yu Panov. Translated by R. Kisch; edited by A. J. Mitchell (New York: Pergamon Press, 1960. 73 p. $3.50).

While inching my way through this tedious little volume—dull in content, drab in format, dour in style—I was time and again reminded of C. P. Snow's recent strictures about the dangers of gadgetry to science.

The field of "automatic translation"—machine translation (MT) is the more usual and precise term—presently enjoys no little scholarly vogue as well as vulgar esteem. It has a sociological symbolic value and answers certain emotional and intellectual group-needs demanded of popular technologies. MT brings together two fashionable subsciences: computer programing and applied structural linguistics. It seems to penetrate into basic areas of science: "giant brains" are "translating" *better than people*. We derive a certain feeling of security that someone is watching the store. The danger that the crucial article (of course, in abstruse mathematics!) will slip by, and that our way of life will thereby be jeopardized is felt to be at a minimum. Panov's book is, as a by-product, a further evidence that the Russians suffer this same syndrome; as such, it is also in passing a sociological document.

Programing a computer to find and release one set in a body of interrelated sets, given certain precipitators with a different structure but given correlates, is not a problem particular to MT. The determination of the units and structures involved is, by definition, the chore of analytical linguistics. Putting the two into a relation where one elicits the other "correctly" has occupied a variety of disciplines for many years. Its interest, indeed, is primarily psychological: it is a hugely complex task which (to use the current jargon) people can be programed to do comparatively easily. The "how" is psychologically significant; the "wherefores" lead to a philosophy of translation and, it may be, a philosophy of symbolism.

One can construct a device which, when fed *Wissenschaft* will bung out *science* and even—marvelous to watch! —when fed *beau* or *belle* will uniformly bung out *beautiful*. We can even subtly improve this: *Beau Brummell* can be made to yield *handsome Brummell*. This is doubtless highly amusing, and there is no reason not to call it translation. It does not answer the question as to what is meant by the relationship *belle, beau,* beautiful, handsome.

A moment's thought should convince that this is neither a mechanical nor a purely linguistic problem, but one involving a theory of symbolism and cognition whose outlines are presently being adumbrated by people as diverse as Ayer, Garvin, Langer, Osgood, and Richards.

I would feel less irked at Panov's book if it considered and/or reported some of these major theoretical problems. As it is, it is a commonplace little report of techniques, uncertain to whom it is addressed, with curious omissions and redundancies, its bibliography restricted to four well-known Western works (one undated, but none, I believe later than 1955). It is hard to see why Pergamon Press rushed it into print so hastily (they apologize for the poor lithoprinting on the grounds of urgency) and without much expected scholarly paraphernalia. (A blurred rubberstamp in the back of my copy seems to indicate that it was printed in the Soviet Union but, characteristically, there is no formal mention as such.)

Russianists and people directly involved with MT will, I daresay, have to read it. But for any others—particularly those to whom it is seemingly addressed, those generally interested in MT techniques and problems, with or without reference to the USSR—it is poor fare. For one thing, the Russian examples—by an irony which makes one furious with the publishers, considering the nature and topic of the book—are neither translated nor done out of the Cyrillic alphabet. By imposing this language burden on the general reader, these examples lose force.

We would expect from the multilingual Soviet Union (where notable work is being done by Georgian, Uzbek, and Armenian scholars, among others) some mention of translating in the *Soviet languages* by machine. There is none. And, since this matter has been much discussed and acted upon in the USSR, we may presume a certain *realpolitik* operating in this regard: that, in terms of total social ecology, it is more economical and practical to teach second and even third languages, and to manipulate deliberately the specialized languages of science and scholarship, than to seriously work toward the infinite diversity of combinations of machine-dictionaries (which involve grammar, syntax, and rhetoric, as well as

lexicon) in a necessarily limited research time.

It would digress too far afield to discuss here the ethnolinguistic and politico-linguistic ramifications of MT. Obviously, it presently enjoys greater esteem than other solutions to linguistic multiplicity. It begs too (it should be mentioned) the evaluative question of the *amount* of dross and trivia already clogging the scientific estuaries of the "major" languages, and how this may increase.

Singer, among others, has written well of the constant interrelationship between technology and basic science: you do not (in his example) make basic discoveries in astronomy unless you have craftsmen to make good telescopes. Technology makes science possible. And technology runs by social exigencies at least as much as by scientific demand.

Yet, social exigencies ever endanger and diminish science. In the cold, keen, unsentimental eye of the history of science (about which Sarton wrote so eloquently and to the present point) the first mouse or hominid on the moon will, like Panov's book and what it symbolizes, have a place. Both are products of a scientifically irrelevant hysteria, and the place, being neither applied science nor disinterested curiosity, will be neither very large nor very honorable.

—WILLIAM KAY ARCHER
Fairleigh Dickinson University

WORLD TV SURVEY

TELEVISION TEACHING TODAY, by Henry R. Cassirer, UNESCO Publications Center, 801 Third Avenue, New York 22, N. Y. (Paris: UNESCO, 1960. 262 p. $3).

Only a few swift years have elapsed since television was first used for the presentation of regular classroom instruction. Since that time in the spring of 1955, the expansion of the use of television for classroom instruction has been remarkable, and the amount of research on its effectiveness, appropriateness, and acceptability has been voluminous.

It is therefore timely that a book should be published which summarizes not only what has been done in the United States, but also what many other countries are doing to adapt the potentials of television to the solution of pressing problems in education.

In *Television Teaching Today*, Henry R. Cassirer, a member of the staff of UNESCO and head of the Television Section of its Department of Mass Communication, has done an outstanding job of presenting a well documented, up-to-date, and balanced picture of the actual use and the potentialities of instructional television.

It is not surprising that over half of Mr. Cassirer's book is devoted to the development of instructional television in the United States since the most extensive use of televised instruction is undoubtedly occurring in this country.

In Part I the author deals with the use of television in schools and colleges in the United States and with costs of equipment for originating and receiving televised instruction. He goes on to discuss the appropriateness of television for presenting instruction in the sciences and humanities, for teacher education, and for professional training in such fields as medicine and dentistry. Mr. Cassirer concludes the first part with a discussion of the relation between television and printed educational media, and advances some theories concerning factors which contribute to effective learning from television presentations.

Part II of *Television Teaching Today* describes developments in the use of television for educational purposes in Canada, France, Italy, Japan, USSR, and the United Kingdom. In these countries, with the possible exceptions of Italy and Japan, television is used to bring "enrichment" into the classroom, rather than for the presentation of substantial segments of regular instruction. Also, in these countries television for educational purposes is mostly under the auspices of government educational agencies operating on a national basis, rather than individual school boards or universities which operate on a local basis as is generally the case in the United States.

Television Teaching Today will be a valuable source of information on instructional television for educators and students of education and mass-communications in the United States. Perhaps its greatest use may be to bring to the attention of educational authorities in many other countries of the world some idea of the role television can play in helping to solve their most pressing educational problem—that of educating many millions of people in the face of a considerable shortage of skilled teachers.

—LESLIE B. GREENHILL
The Pennsylvania State University

LIBRARY STANDARDS

STANDARDS FOR SCHOOL LIBRARY PROGRAMS. American Association of School Librarians (Chicago: American Library Association, 1960. 132 p. $2).

Recognizing that "in the education of all youth, from the slowest learner in kindergarten to the most intelligent senior in high school, an abundance of printed and audiovisual materials is essential," and firmly convinced that ". . . recommendations for the improvement of schools . . . can be fully achieved only when the school has the full complement of library resources, personnel and services," the authors of this book, with the assistance of a large number of representative administrators, teachers, school librarians and other instructional materials specialists, have developed a fresh list of qualitative and quantitative standards for functional school library programs. It is their intention that school-board members, administrators, teachers, librarians, and interested laymen use these standards as guides in appraising existing school libraries and in making immediate and long-range plans for the development of school library programs.

Specific attention is given to the needs of small schools, new schools, and schools just starting library programs as well as to larger schools with library programs underway. The school library services of individual schools, district or regional materials centers, and state agencies are dealt with directly and in considerable detail.

National standards for school libraries are not new. As most school people know, such standards in one form or another have been in existence for many years. Those set forth in this book were, in fact, designed to replace those published 15 years earlier in *School Libraries For Today and Tomorrow*.

The decision to develop new standards was prompted in large part by the fact that over the past several years many schools with forward-looking library programs have found the earlier standards inadequate as guides for the further development of their programs. Leaders in the school library field also

knew that the many developments in elementary and secondary education during the past decade and a half called for the reassessment and likely revision of many of the older standards. Consequently, even though library service is still either inadequate or even non-existent in many schools, it was decided that the old standards should be brought more into line with the needs of the better schools of today, and made more consistent with the practices of the better libraries now found in a good many schools.

The ways in which the new standards were developed are of major significance. First, the American Association of School Libraries, under whose sponsorship this project was conducted, established a School Library Standards Committee to which 20 professional educational organizations (including the Department of Audiovisual Instruction of the National Education Association) appointed representatives. This committee gave valuable assistance in planning revision procedures, in formulating a philosophy of school library service for the present, and in appraising three preliminary drafts of this book. The authors report that the executive boards of most of the organizations represented on the committee reviewed the standards before their publication, but that they did not necessarily endorse completely all aspects of the standards.

Second, the Committee drew heavily on the judgment and experience of a large number of administrators, teachers, and librarians. Another group to which the Committee and the authors turned for advice and criticism was composed of consultants in special areas such as the audiovisual field.

Part I contains an outline of the objectives of the school library program, and a discussion of the scope of this program and those aspects of it which deal with reading, reference service, guidance of reading, listening and viewing, instruction in the use of materials, research, personal and social guidance, and the use of student assistants. At all points it is clear that libraries and the services they render should be directed toward the facilitation and improvement of the education of boys and girls. The individual learner and his teacher are the ones to be served. Equally clear is the point that in order for a school library to achieve this goal, it must have proper and adequate personnel, materials, financial support, space, and equipment. With reference to these matters it is important to note that the authors place heavy emphasis on the point that "*these essential elements for a dynamic library program are interlocking and interdependent, and this relationship must be kept in mind in interpreting the quantitative standards recommended in this . . . book.*" (Italics theirs.)

Part II is devoted to planning and implementing school library programs. In dealing with this topic, the authors identify and discuss activities relating to libraries which are the responsibility of board members, school administrators and library supervisory personnel at state and local levels. The responsibilities of curriculum coordinators and teachers for school libraries are also specified and discussed. In addition there are recommendations regarding organization and administration of supervisory services, qualifications and preparation of various types of school library personnel, size of library staff, the education of teachers with reference to school libraries, the resources needed for this, and the characteristics of a good demonstration school library.

Part III deals with resources for teach-

ing and learning. Principles for the selection of materials, policies and procedures for making materials accessible to pupils and teachers, and techniques for making it easy for them to use materials are points of emphasis. Special attention is given to small and new schools. Finally, the authors discuss the importance of cooperative planning for school libraries stressing the need for sharing certain materials and services through district materials centers.

The recommendations in Part III are no less specific than those in Part II. The authors are quite explicit about size and nature of collections of books, magazines, newspapers, films and filmstrips, disc and tape recordings, pictures and slides, realia and other materials. They give definite advice on the development of collections of supplementary materials and professional materials for faculty. They have been realistic and practical in suggesting principles for planning annual expenditures and in recommending amounts that should be budgeted for various types of materials.

Of particular usefulness is a chart on pages 24 and 25 which summarizes the major quantitative standards for school library programs. Other valuable features are the selected bibliography on recent trends in education and related library references, the appendix which sets forth policies and specifications for library quarters and equipment for schools enrolling 200 or more students, and the index. To facilitate and focus discussion of the standards, a guide has been provided.

The possibility that standards may become ceilings for educational practice is always present. The authors recognize this, but point out that it is the responsibility of educational leaders (both professional and non-professional) not to let this happen. They also make clear that the standards presented, although still beyond the reach of many, are not absolute and must be revised as conditions and objectives evolve.

Undoubtedly, many regular readers of *AVCR* will want to know the authors' attitude toward audiovisual instruction and audiovisual specialists. This reviewer believes it is most friendly and favorable. They believe teachers and pupils need all types of materials and materials services to build an adequate educational program, and they contend that the school library should be a center that provides the total range of instructional materials and services. However, they strongly stress that the center's personnel must be committed to the idea of this arrangement and that they must be properly prepared to handle all types of materials and services. They have made it clear that librarians and audiovisual specialists have the same goal—the improvement of instruction—and must, therefore, work together.

—PAUL W. F. WITT
Teachers College, Columbia University

NO EASY ANSWERS

SELF-ORGANIZING SYSTEMS: PROCEEDINGS OF AN INTERDISCIPLINARY CONFERENCE, edited by M. C. Yovits and S. Cameron (New York: Pergamon Press, 1960. 322 p. $10).

The interdisciplinary conference has become firmly established on the scientific scene. The success of these conferences and the demand for the often hurriedly prepared proceedings testify to their general appeal. This particular conference, I suspect, will be no excep-

tion. Held under the joint sponsorship of the information systems branch of the Office of Naval Research and the Armour Research Foundation, the conference should interest all concerned with aspects of machine or human behavior which show modification toward greater structure or organization.

A total of 14 formal papers are brought together in the book, representing contributions from the fields of biology, engineering, mathematics, and psychology. These papers can be divided into four roughly determined sections: (1) perception of the environment, (2) effects of environmental feedback, (3) learning in finite automata, and (4) structure of self-organizing systems.

The first section presents papers on "Self-organizing Models for Perception" by B. G. Farley, "On Self-organizing Systems and Their Environments" by H. von Foerster, "Statistical Models for Recall and Recognition of Stimulus Patterns by Human Observers" by W. K. Estes, and "Perceptual Generalization over Transformation Groups" by R. Rosenblatt. The papers within this section propose a number of alternative formal models for viewing the organization of input to organisms or systems which display differential response properties of learned perception. The von Foerster paper presents an entertaining proof of the impossibility of a self-organizing system. The other papers take up the problems of perceived stimulus similarity and differentiation. It is this section that should have maximum relevance for the readers of *AVCR*. The papers do not, however, offer any practical help in the immediate problems facing the individual concerned with utilizing perception as a means of communicating. On the contrary, the simplest questions are posed, questions concerned with the processes of categorizing simple stimulus events. This turns out to be a question relating the mapping of stimulus elements onto the range of neutral and functional events of the perceiving system. The reader should be forewarned that answers even at this simplest level are not readily apparent.

The second section contains "The Organization and Reorganization of Embryonic Cells" by R. Auerbach, "Further Consideration of Cybernetic Aspects of Homeostasis" by S. Goldman, and "Feedback through the Environment as an Analog of Brain Functioning" by G. H. Bishop. These three papers are almost entirely biological in orientation. Their merit derives from the application of the cybernetic model of control to the evolution and development of the human *qua* biological system.

The third section includes the papers "A Variety of Intelligent Learning in a General Problem Solver" by Newell, Shaw, and Simon, "Learning in Neural Systems" by P. M. Milner, and "Blind Variation and Selective Survival as a General Strategy in Knowledge-processes" by D. T. Campbell. The paper by Newell, Shaw, and Simon is of particular interest to those concerned with the progress being made in the programing of computers for "intelligent" self-organizing behavior. These authors have gone far in other publications toward the successful completion of programs for chess and other games. The general problem solver is designed as an all-purpose machine for simulating thought process behavior. Such attempts at simulation yield analogical hypotheses regarding brain function, and as such represent an exciting area of research.

The fourth section of the book contains several papers which are directed

toward considerations of the formal aspects of the models and computers discussed in the earlier papers. The degree of mathematical sophistication demanded is quite high in this section.

None of the papers in this book will be entirely intelligible to the average specialist in any one given field. The simultaneous advantage and disadvantage of the interdisciplinary approach are present in this book. With this caveat, the information which does seep through the "noise" can be highly useful to us, the self-organizing readers.

—MURRAY S. MIRON
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NOTES AND COMMENT

Aside from *AVCR*, there are perhaps half a dozen scholarly and research periodicals which regularly publish material relevant to the concern with the quality and nature of communications in education. A relative newcomer (at least in its present form) is *Search*, published six times a year under the supervision of Donald E. Wells, Director of the National Project in Agricultural Communications ($5 a year, NPAC, Wells Hall, East Lansing, Michigan). Each issue of *Search* consists of the summary and interpretation of a major communication study, and a number of loose-leaf "take-aparts" presenting one-page interpretive reviews of other studies, designed for separate use and filing.

In its short history, *Search* has covered a broad area in lucid and pointed style, dealing with media use patterns, diffusion, motivation, persuasion, typography, design, audiences, leadership, and sense modality in communication. Its second issue in 1961, for example, carries a major report on the Michigan studies of "The Public Image of Higher Education," and "take-aparts" on the function of threats in communication, the urban community press, role of audience values in the adoption of new ideas, the social structure of a news room, international communications, and factors determining who goes to college.

* * *

Studies in Public Communication (Department of Sociology, University of Chicago, $1.50 per copy) is an occasional journal that explores issues and directions in communication research, media policy, and the study of popular culture. Its summer 1961 issue is noteworthy in two major respects. First, in an editorial note Edward C. Uliassi calls for bridging the gap between the insights, breadth, and freshness of journals of opinion and the narrowly-empirical precision of academic journals in the communication field. He cites areas of basic research neglected because of methodological constraints and inhibitions, and other approaches overworked because of the illusion of precision they yield.

In a passage revelant to communication research in the AV field, Uliassi raises the question whether much current research has not substituted "one mode of imprecision, currently fashionable, for another, currently unfashionable. The imprecision of interpretive, multivariate, historical analyses of complex processes and problems has yielded to the currently more acceptable mode of imprecision: the imprecision of artificially-simplified studies whose narrow empirical character makes them only partially relevant to the actual social situation being studied. The case is analogous to that of looking under a street lamp for a coin lost in a forest—because the light is better there."

The second major noteworthy feature is a symposium "The Great Debate on Cultural Democracy" headed by Bernard Berelson's imaginary debate between Academicus, Practicus, and Empiricus. Other contributions and research reports help make the third issue of *Studies* an outstanding contribution to communications scholarship and research.

* * *

The Influence of the Cinema on Children and Adolescents: An Annotated Bibliography is the latest (No. 31) in UNESCO's series of Reports and Papers on Mass Communication. It summarizes 491 studies from many countries, which makes it one of the most extensive of such bibliographies in print. References are arranged under "General Works," "The Attitude of Youth toward the Cinema," "Analysis of Film Content," "The Process of Seeing a Film," "Influence and After-Effects of Films," "Educational Aspects and Practical Measures," and "Miscellaneous." The introductory "Survey of Trends" notes that "while there is no unanimity about the direct influence of the cinema, a majority of authors speak of indirect and unconscious influences. . . . It is widely argued that the repeated presentation of certain themes and behavior patterns on the screen has much more likelihood of producing a long-term, indirect effect than the immediate, overt influence of any individual film, however specific."

Other recent reports in the same series include *Developing Mass Media in Asia* (1960, $1.50), *Film-making on a Low Budget* (1960, $0.50), *Visual Aids in Fundamental Education and Community Development* (1959, $0.75), and *Adult Education Groups and Audio-Visual Techniques* (1958, $0.75). All publications can be ordered from UNESCO Publications Center, 801 Third Avenue, New York 22, N. Y.

* * *

The Library of Congress recently published a checklist of its sound recordings of poetry and literature; it makes available to the public for the first time a detailed inventory of this collection of materials that are in many instances unique.

Copies of the 132-page, paperbound brochure, entitled *Archive of Recorded Poetry and Literature: A Checklist,* may be purchased at 70 cents a copy from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. (It may also be purchased by visitors to the Information Desk in the Main Building of the Library of Congress, but mail orders should be addressed to the Government Printing Office.)

The Library of Congress gathered this archive of sound recordings in four

ways: (a) by recording the public lectures, poetry readings, or dramatic programs presented in the Library's Coolidge Auditorium—among which are featured such literary figures as T. S. Eliot, Robert Frost, Robinson Jeffers, Thomas Mann, W. Somerset Maugham, and Carl Sandburg; (b) by recording special readings by poets and other writers in the Library's Recording Laboratory, or by recording interviews with them during their visits to the Library—for example, readings by Babette Deutsch and Maxwell Bodenheim, and interviews with H. L. Mencken and Ogden Nash; (c) by obtaining recordings from poets—such as Phyllis McGinley and Rolfe Humphries—who could not come to the Library to read their work but whose recording expenses were met by a foundation grant; (d) by exchanges or by gifts of recordings made elsewhere, among which are represented the voices, for example, of Robert Browning, James Whitcomb Riley, William Jennings Bryan, and Edna St. Vincent Millay.

* * *

In the last issue of *AVCR* we called attention to a report of a conference on *Popular Culture and Personal Responsibility*. The sponsors of that conference have now published *A Study Outline* (prepared by Brian Groombridge for the National Union of Teachers, Hamilton House, Mabledon Place, London W.C., England, 56 p. 1s 6d.) to accompany the conference report—or to be used without it. The *Outline* is actually an organized compilation of quotes from the conference and other sources, representing the state of British opinion on the subject of the educational responsiblities involved in mass media and commercial popular culture. Beginning with the reasons for educational concern, the line of argument develops the issues, gives proposals for education and for social action, and concludes with suggested questions for discussion and a brief bibliography. We don't know of a more meaty and provocative discussion guide on this subject.

* * *

Also from England comes *Film and Television in Education for Teaching* (British Film Institute, 81 Dean Street, London W.1, 1960, 66 p. 2s 6d.), a report of a Joint Working Party of the Association of Teachers in Colleges and Departments of Education and the British Film Institute. The report argues the urgency and documents the extent of film and television study in schools. It sketches the range of opportunities awaiting the enterprising and imaginative teacher in this field, and states that "this kind of competence is as basic to the equipment of a teacher as English or arithmetic has often been considered in the past."

And we have received the following note from N. March Hunnings, editor of *Cinema Studies* (published in London by The Society for Film History Research):

> We were delighted to read the kind words you say about us in your January-February 1960 number. But would that we still had *Sight and Sound* and *Sequence* and *Close-up* and *Definition*! . . . *Sight and Sound* is still with us, thank goodness, and *Definition* seems to be finding its feet although this was far from certain when our first issue appeared. Another monthly you may like to note, published by the Federation of Film Societies, is *Film* which has been somewhat parochial hitherto, but is now taking an active part in the very lively controversy raging here over the basic tenets of film criticism—form versus content.

* * *

The June 1961 issue of the *AAUP Bulletin* invites comments on the preliminary draft of Committee C's policy statement on educational television. The statement urges proper safeguards to ensure (a) faculty responsibility for program content and objectives, (b) freedom of inquiry unhampered by financial and other considerations, (c) opportunity for student participation, (d) standards of admission and credit, (e) adequate time for special faculty preparation, and (f) the right of teachers to control subsequent or continued use of recorded programs. It also recommends "continuing research . . . to determine the effects of television courses on the students' learning, on the conditions of teaching, and on the academic community in general." Direct comments to the American Association of University Professors, 1785 Massachusetts Avenue, N.W., Washington 6, D. C.

* * *

Most of the June 1961 issue of *The Journal of Communication* is devoted to a symposium on nonverbal communication. Coeditors Joel R. and Lois J. Davitz selected papers "oriented primarily in terms of psychological investigations of vocal and graphic communication." They themselves contribute a paper on nonverbal vocal communication. Bernard Kaplan presents an approach to the problem of nonverbal and verbal symbolic representation.

* * *

Reprint of "Televiewing by Children and Youth; Eleven Years of Surveys and Studies" by Paul Witty (*Elementary English*, February 1961) is available free of charge from Department AV, Television Information Office, 666 Fifth Avenue, New York 19, N. Y. A booklet containing the four summary chapters of the significant Nuffield Foundation Study, *Television and the Child* by Hilde T. Himmelweit, A. N. Oppenheim, and Pamela Vince (London: Oxford University Press, 1958) can be obtained, also free of charge, from the same source.

* * *

The National Council of Teachers of English has initiated a new monthly publication, *Studies in the Mass Media* (NCTE, 508 S. Sixth Street, Urbana, Ill.; $2.00 a year or $35.00 for special class subscription of 35 copies). *Studies* is published eight times a year. It contains motion picture, television, drama, and recording study guides and articles on forthcoming films and programs.

* * *

Recent publications of programed learning and other technological developments in education include the summary of a conference: *Programed Learning and the Educational Process,* edited by Annice L. Mills (Thomas Alva Edison Foundation, 8 West 40th Street, New York 18, N. Y., 1961); "Technology in the Classroom; Challenges to the School Administrator by Gene C. Fusco (*School Life,* March and May, 1960); and a symposium on "Automation in Education; Machines and Men as Teachers and Learners" (*Teachers College Record,* December 1960). Also from Teachers College comes the limerick published in the June 1961 issue of *Current* (magazine of "The Significant New Material from All Sources on the Frontier Problems of Today"):

The latest report from the Dean
In praise of the teaching machine
Is that Oedipus Rex
Could have learned about sex
By himself, and not bothered the Queen.

—G. G.

KEEPING UP WITH THE FIELD

INTRODUCING THIS department in the March-April issue this year, we explained its aims under the title "Systematic Coverage for a New Educational Field," and stated: This "department will present articles, abstracts, and news notes dealing with research and experimentation on auto-instructional methods and media." To this end, we continued, "theoretical papers, reports of completed research, and notes on experimentation or programming developments in progress, together with information on new techniques or hardware in the teaching machine field, will be considered appropriate for publication* in this department."

It is now apparent that in trying to do these things—as the field continues its "bustin' out all over" at an exponential rate—this AVCR department can present only a small fragment of what is pertinent, timely, and significant.

Accordingly, in addition to the two provocative articles for this department in this issue, it seems appropriate to furnish a list of other key sources of information. The list should prove useful to the ambitious reader who wants at least to try to keep up with the field—if not to lead it. (As to the leadership needed now, see the final remarks in R. F. Mager's paper, p. 304, this issue.)

In addition to the DAVI-published Lumsdaine-Glaser source book, *Teaching Machines and Programmed Learning*, and prior to the publication of a second such NEA-sponsored volume in a year or so, the following leads may be helpful:

1. Current periodicals devoted exclusively to auto-instructional devices and programed learning:

a. *AID—Auto-Instructional Devices.* Presenting news notes, short articles, and many leads to further sources of information, it is published monthly by the Institute of International Research and Development, Inc. (INRAD), Educational and Training Methods Division, P.O. Box 4456, Lubbock, Texas.

b. *Programed Instruction.* This useful bulletin is published periodically by the Center for Programed Instruction, Inc., 365 West End Avenue, New York 24, New York.

c. *Automated Teaching Bulletin.* Several issues have been published at irregular intervals by the Rheem Califone Corporation, 1020 North La Brea Avenue, Los Angeles 28, California.

* Manuscripts should be sent in duplicate, typed double space, directly to Dr. A. A. Lumsdaine, Department of Education, University of California, 405 Hilgard Avenue, Los Angeles 24, California.

2. Other periodical sources of information:

a. *Audiovisual Instruction.* Published by DAVI, of course. See especially the April 1961 issue (50 cents) entitled "Self-Instructional Devices." It presents a list of teaching machine manufacturers, programed materials, and other pertinent information.

b. *AV Communication Review.* Its special supplement Vol. 8, No. 2, 1960, prepared by E. B. Fry, *et al.*, and entitled "Teaching Machines: An Annotated Bibliography" is now largely superseded by the more comprehensive annotated bibliography in the Lumsdaine-Glaser source book, *TMPL.* Another supplement, Vol. 9, No. 3, May-June 1961, was prepared by J. W. Rigney and E. B. Fry. Entitled "Current Teaching Machine Programs and Programming Techniques," it presents a considerable number of program samples from a variety of sources; available from DAVI at $2.00.

c. *Contemporary Psychology,* published monthly by the American Psychological Association, 1333 16th St., N.W., Washington 6, D. C. Reviews of self-instructional programs appear in its "Instructional Media" department, starting with the January 1961 issue.

3. Further sources of information:

a. Workshop results: Several workshops have been held during the summer of 1961 on methods and techniques of programing for auto-instructional materials, and many more are in prospect. One of the principal sources of information on these is the Center for Programed Instruction. (For its address see 1.b above.) Another is the American Institute for Research, 410 Amberson Avenue, Pittsburgh 32, Pennsylvania.

b. Stolurow, L. M. *Teaching by Machine.* Washington 25, D. C.: Office of Education, Department of Health, Education and Welfare, 1961. 163 p. (65 cents.) It is a valuable compendium of information relating to teaching machines: research findings, concepts and techniques, descriptions of types of machines, and a discussion of programing processes.

c. *The NEA Technological Development Project,* under the direction of James D. Finn assisted by Lee E. Campion, is generating a large amount of useful information about programs and devices. Both DAVI journals will carry announcements about this forthcoming information.—A. A. L.

. . . *learning step by step*

> Constructed-response programming was developed by Skinner . . . from his work with operant conditioning. Briefly, the philosophy is that the student can be led to the desired terminal behavior through many successive steps, each reinforced by knowledge of results. The trick for the programmer is to discover the particular sequence of steps which will lead the student to the desired outcome with a minimum (but not necessarily zero) number of errors along the way.
>
> From "Current Teaching-Machine Programs and Programming Techniques." Joseph W. Rigney and Edward B. Fry. *AV Communication Review,* Vol. 9, No. 3, 1961. p. 9.

TEACHING MACHINES AND SPELLING

J. A. R. Wilson
and Mildred C. Robeck

Dr. Wilson is associate professor of education and Dr. Robeck is assistant professor of education at the University of California at Santa Barbara.

THE PROMISE THAT WE can improve many facets of our teaching by the use of teaching machines is stimulating psychologists, educators, book publishers, and equipment manufacturers to rush ahead with the development of programs and hardware.

There are two major theories as to the way programs should be constructed, with as many variants as there are workers in the field. Skinner believes in adding small increments to learning by operant conditioning (5). He is sure that having the subject compose his response is important if this learning is to be most efficient. This approach represents a form of S-R connectionism in background and orientation.[1]

Crowder takes larger bites of the material to be learned (1,2). His programs work better when that material can lead plausibly to wrong answers. The mistakes can then be used to clarify the ideas that are to be grasped. Understanding and concepts fit into this type of programing most easily and with the least distortion. The orientation is essentially Gestalt. Crowder believes that it is really immaterial whether the answer is composed or selected since, in any case, it will be predetermined by the structure of the material being learned. Because the selected response is more easily managed, this has been his choice.

It would be unfortunate to overlook the complementary nature of these approaches. It is easy, but imprudent, to take sides. One type of program is almost certainly better than another for certain kinds of learning.[2] It is necessary

[1] [For authoritative papers dealing with the major learning theories and their relationship with automated teaching, see *AV Communication Review*, Vol. 9, No. 5, Sept.-Oct. 1961.—Ed.]

[2] [Similarities and differences between Crowder and Skinner-type approaches to programming are discussed by Lumsdaine in *Teaching Machines and Programmed Learning*, p. 517-39. For Lumsdaine's more detailed discussion, see "Some Differences in Approach to the Programming of Instruction." *Programmed Learning: Evolving Principles and Industrial Applications*. (Edited by J. P. Lysaught.) Ann Arbor, Michigan: Foundation for Research on Human Behavior, 1961. Lumsdaine presented a modified version of this paper at the American Management Association meeting in New York, September 1961. The University of California in Los Angeles has recently initiated a research project which will experimentally evaluate variables differentiating the two approaches and also the interaction of these variables with differing kinds of learning material.—Ed.]

to select the type of program that seems most promising for the material to be learned. The whole teaching-machine approach to learning is on trial as far as most teachers are concerned. Therefore, as teachers try out teaching machine techniques, it is important that the right selection is made as to which of the programing approaches will insure success. A speedy advance of automated teaching is desirable—but not if it leads to hastily prepared programs which will cause teachers to judge not only a specific program as a failure, but also the entire field of automated teaching.

Spelling is a troublesome school subject. Students in any class require varying amounts of time to learn the same list of words, and different students need different lists of words. To go by average performance is not adequate. There seems to be hope that spelling can be programed so that an individual student can proceed at his own rate and work until he achieves complete mastery.[3] Spelling can be considered as essentially a series of conditioned responses. Whenever one must stop to think of the way to spell a word, there may be increased probability that the spelling will be wrong.

Holmes and Hyman, working at the Veterans Administration Hospital in Los Angeles, obtained some significant facts which indicated the necessity of requiring a constructed response in learning spelling (3). Briefly, they found that brain damage to a truck driver caused by a blow on the head from a beer bottle made it impossible for him to construct a spelling response. He could not type the response, nor write it, nor spell it orally. He could, however, select the correct spelling from a multiple-choice list. Unfortunately, to use spelling it is necessary to write or to type the word, not merely to select it from a group.

To teach spelling, we must insure that the brain functions as it will have to function for use of the word in written work. Penfield and Roberts, in a study of the brain mechanisms of speech, described the dysphasia which occurred after excision of various specific cortical areas (4). They used sodium amytal injections to map the functioning of the brain areas prior to surgery. Among many cases they described was a young man whose operation was followed by severe transient dysgraphia—the inability to produce written responses when the inability is not a muscular malfunctioning. This patient, however, had no difficulty in spontaneous speech, naming, or reading (4:146).

The implications of these studies are that programs which teach spelling should be based on constructed responses rather than multiple-choice responses. In other words, they should be fitted to the Skinnerian type of machines rather than to the Crowder type. A great deal of time and money will be saved and many teachers will be kept from disillusionment if the essential nature of the structure of spelling is realized before spelling programing is undertaken.

Since there are many paths to the Promised Land, these viewpoints—while not Sinaitic—could save some unnecessary wandering through the wilderness. There are many ways of learning, but different

[3] [Porter has carried out extensive work using teaching machines to teach spelling. See Porter, D. "Some Effects of Year Long Teaching Machine Instruction." *Automated Teaching: The State of the Art.* (Edited by E. H. Galanter.) New York: John Wiley and Sons, 1959. p. 85-90. Also see Popp, Helen and Porter, D. "Programming Verbal Skills for Primary Grades." *AV Communication Review*, Vol. 8, No. 4, p. 165-75.—Ed.]

kinds of learning require different ways. A proper choice of the way will benefit all.

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WHAT ARE TEACHING MACHINES DOING TO TEACHING?

R. F. Mager

This paper is an edited version of the address the author gave at the annual meeting of the Audio-Visual Education Association of California at Long Beach, California, in February, 1961. Dr. Mager is a psychologist with the Central Research Laboratory of Varian Associates in Palo Alto.

AN EXCELLENT PAPER by Eboch has provided an overview of the auto-instructional field: the origin, the reasons behind, and the devices and programing techniques involved in what we so loosely call teaching machines.[1]

When this subject is discussed in the presence of those engaged in public education, two questions are frequently asked. First, "What is all this going to mean to me and my job?" Second, "What should I do about it?" These matters, obviously, are of some concern to the teaching profession. The fact that there are no neat and prepacked answers should not prevent us from considering the questions—and to consider them is just what Harry Skelly has asked me to do.[2]

Exploring them, I should like to discuss four of the influences which I believe will surely be felt as teaching

[1] At the meeting, Sidney C. Eboch, assistant professor, Division of Teacher Education, San Jose State College, introduced the general field of auto-instructional methods and devices.

[2] Harry J. Skelly, Chief, Bureau of Audio-Visual and School Library Education, California State Department of Education.

devices and programs become more widely available.

Behaviorally-defined Goals

The first of these has to do with the clarification of educational objectives. To program *effectively* for a teaching machine, it is necessary to specify the objectives in great detail, both in performance terms and in measurable terms. That is, before an intelligent selection of subject matter and its sequencing can be accomplished, it is necessary to spell out in behavioral terms just what the learner will be *doing* when he is demonstrating that he has achieved the objectives.[3] Similarly, before a program can be evaluated, before it can be tested to determine how well it achieves what it is supposed to achieve, the objective must be spelled out in *measurable* terms. Of course, it isn't necessary to specify objectives in measurable terms in order to write a teaching machine program, any more than it is necessary to specify objectives clearly in order to teach a course: It is necessary to do this, however, and also to test a program in order to make meaningful claims about its effectiveness.

We have no difficulty in agreeing on generalities. We can all agree, for example, that such things as democracy, learning, knowing, and understanding are good. As long as we can talk about these things in such a general fashion that they can be interpreted in varied ways, we can all agree that they are desirable goals. But to the extent that our goals are stated in general terms, the statements fail to tell others just what our educational intent might be. Many readers must have tried to work with teachers whose presentations no audiovisual specialist could improve—though they needed improvement—simply because those teachers did not know just what they wanted to achieve.

If the objectives of a teaching-machine program are not clearly specified—if it is not clear which skills and what knowledge the students who use the device should acquire—then it is entirely possible that the goals reached by the program will be in conflict with the goals of the teacher. Should such a situation arise, the use of an effective teaching device and program will prove to be a liability to the teacher, rather than an asset. Clearly, such a possibility is reduced to the degree that the objectives of both teacher and program are clearly specified.

To cite one example: we can all agree that algebra is useful, and we know the subject matter a course in it might offer. But since several different skills can be taught under the general heading of algebra, it is quite conceivable that students who learn algebra from a teaching machine could fail on a teacher's standard final examination. If, for example, the teaching machine taught the student *equation-solving* skills, but the teacher tested for *word-problem* skills, that teacher would probably judge the teaching machine a failure. A similar situation could easily come about in any educational field when goals are not specifically stated.

The point is that if a teacher wants to use a teaching device to help him reach his own educational objectives, he must not only insist that the program publisher tell him exactly which objec-

[3] [A number of other research workers have also pointed out the importance of explicitly-stated, behaviorally-defined educational goals. See the concluding remarks by Lumsdaine and Glaser in *Teaching Machines and Programmed Learning: A Source Book*. Department of Audiovisual Instruction, National Education Association, 1960. p. 563-72.—Ed.]

tives the program is designed to achieve, but, also, he must know in considerable detail the objectives he, himself, wants to achieve. Thus, the development of automated instruction may impel the teaching profession to become more concerned with the development of precisely-stated educational objectives.

Subject Matter Organization

A second influence I think the advent of self-instructional devices will have upon teaching has to do with the organization of content. One essential to teaching-device success is a high degree of subject matter organization. The program must not only aim at desired behaviors, but it must also present the material in such a way as to cause the learner to *exhibit* those behaviors. It is also necessary to include in the program *all* the elements of the skills and knowledge we desire to teach, and to develop a careful sequence of this material. Now, the process of content organization (with respect to the achievement of specific objectives) almost always results in the discovery and deletion of a good deal of unnecessary and irrelevant material. As a result, the advent of the teaching machine will demonstrate that many of the traditional and desirable educational objectives can be reached in considerably less time and with less effort than is now the case. Those who know something about the preparation of materials for television teaching also know that by the time an instructor has spent 10 to 24 hours preparing a single hour of instruction, he has reduced his original 50-minute lecture to a 20- or 30-minute presentation.

If a course of instruction can be effectively taught in half the time currently allowed, we will be faced with the question of what to do with the remaining time. Should we increase the amount of material to be learned in a given course? Should we reduce the length of the course? Should we abandon the notion of a course, and allow the student to progress according to his ability to achieve the objectives set out for him? Regardless of which alternative you might prefer, the advent of the teaching device will undoubtedly require some important changes in the organization of the day of both the teacher and learner.

Pride in the Profession

A third influence the teaching machine will have relates to the job satisfaction of the teacher. This prediction is hardly risky, since *any* change in job procedures or job tools changes the job itself. But whether automated instruction improves the job of teaching, whether it increases or decreases the satisfaction and prestige to be found in the profession will depend upon the individual. The teacher who derives his primary satisfaction from the belief that he should be completely free to do as he pleases in his classroom will have a difficult time. So will the teacher and administrator whose primary satisfaction stems from the preservation of the *status quo* and whose battle cry is "Don't make waves." They will be drowned in a sea of unhappiness and frustration. On the other hand, the vast majority of teachers, whose primary satisfaction is directly proportional to their students' achievements, will experience a significant expansion in the pleasure of teaching.

With the teaching machine sharing the burden related to the teaching of the elements of a subject, the teacher will no longer have to spend much of his time behaving like a two-legged tape recorder

emphasizing the same fundamentals year after year. Instead, he will have time to explore with the brighter students the more intricate aspects of the subject matter, and to help the slower student master the required skills. In short, the teacher should have the time and opportunity to engage in the activities most worthy of his profession. And who knows, he might even have the opportunity to shed himself of some of the activities expected of bookkeepers and clerks. And imagine what a thrilling experience it would be to greet (for a change) a new class of students who could actually demonstrate all of the skills and knowledges you have specified as necessary prerequisites to your course.

Competition by Industry

The fourth influence I want to talk about is probably both the healthiest and the most disturbing: competition. Though the public schools have always had competition from the various private and church schools, it is possible they will soon be in competition with those most qualified to succeed in a competitive situation. I refer, of course, to industry.

Consider these circumstances: Colleges and universities are now unable to keep up with the increase in college-age population. Dr. Robert M. Hutchins, in a recent talk at Stanford said "American universities will not be able to grow fast enough to keep their standards low." More and more students will be turned away as entrance requirements become more and more demanding. In other words, it is clear that during the next ten years it will become more and more difficult to insure a college education to those who want it. Should any segment of industry decide that it would be to its advantage to provide company employees' children educational assistance through company-operated training facilities, it will not hesitate to develop such a capability. Already, industry spends close to two billion dollars annually on internal training. To add a facility providing this additional educational assistance through teaching devices and programs, or by other means, would cost little in comparison. Such a step would be a small one for industry to take not only because it already has extensive training facilities, but also because there is no teacher shortage in industry. Every company has former teachers and former professors from all disciplines. We have enough at our own company to staff a medium-sized university.

Other circumstances which might bring about educational competition from industry stem from two facts: (a) at least half the programers of self-instructional materials are programing in industry; (b) the use of automated instruction for industrial training is rapidly increasing. Company trainees who learn successfully from teaching machines frequently ask why these devices are not available to their children.

The final circumstance which might cause industry to go into the child educating business has to do with the problems and techniques of personnel recruiting. Industry burns many candles at both ends to develop new or more effective ways of attracting desirable personnel. The various lures and fringe benefits available at one place or another are well publicized. The advent of the teaching machine, however, provides the first opportunity in several years to offer a new and different kind of fringe benefit. It may not be long before some company will offer as an inducement some form of educational assist-

ance to its employees' children. If this inducement should be successful in recruiting desirable personnel, it is inevitable that other companies would follow suit.

Summary

These, then, are four ways by which the teaching machine is likely to affect the teaching profession. But what should all this mean to the role of the audiovisual specialist?

When the AV specialist came on the scene, he set himself up as an expert in the use of audiovisual techniques. He said to teachers, "I will be happy to manage your audiovisual equipment. I will collect it. I will maintain it, and I will dispense it. I will also teach you how to use the audiovisual equipment we have, and I will keep myself informed of new developments so that I can advise you on where and how these new techniques might be of value."

Since then, only two really new and important audiovisual developments have come along—the language laboratory and educational television—and most AV specialists missed the boat both times. Most teachers and administrators had to go to some outside source for information because their AV specialist was not prepared to supply them the facts they needed for decisions about their use.

The third boat is leaving the dock right now in the form of teaching machines. And how well prepared are you? Do you understand why the teaching machine achieves the results it does? Do you understand the features of the machines you see around you and the important differences between them? Can you advise administrators on which machines and which programs, if any, to buy? Can you tell teachers how to evaluate the effectiveness of a machine or a program, or both?

When you took the films from the desk drawers of teachers and the movie projectors from classroom closets, and put them under your control so that you could "make them available to everybody," you also accepted the responsibility to keep the teachers you serve informed of new developments. Consequently an AV specialist is obligated to learn about new teaching devices before the teacher does.

In the development and implementation of auto-instructional techniques, the audiovisual specialist can play a key role. He can influence the *direction* and the *rate* of educational progress and change. But key people are leaders, not followers; they are more experienced and more knowledgeable than their colleagues. They are active people. If the AV specialist merely reads the articles on teaching machines and listens to pertinent talks that happen to come his way, he will not learn enough quickly enough about this new development. If he does not do anything more useful with his time than to think up new ways of cataloging his films, he will squander his effectiveness and his right to be called an AV specialist.

I hope this will not happen. I hope he will take his title seriously and will become expert with the new tools of his trade which, by his own assertion, now include self-instructional devices. To do this, he will have to spend more time in learning by doing: initiating workshops, selecting a program and trying it out by himself; then with the cooperation of appropriate teachers, evaluating the results of these tryouts. He will have to learn how to help teachers incorporate these devices into their courses, if such action seems advisable. He will have to

insist that ambitious colleagues like Kemp,[4] who has already programed a portion of his AV course, publish or otherwise distribute their programs so that others may learn from them. Finally, if automated instruction seems worthy of incorporation into any part of the curriculum, he will have to prepare his own courses according to the principles and techniques he will be trying to disseminate.

The world of education is in rapid motion. In the exciting days ahead, the AV specialist can become a key figure. Or he can sit on his apathy, and let the rest of the educational world go by. The decision is his.

[4] Jerrold E. Kemp, Coordinator, Production Services, San Jose State College, Santa Clara County, California.

A Scholar's Toast

Scholars, fellows, and staff of the Folger Shakespeare Library in Washington, D. C. proved at a recent Elizabethan-style banquet that "one maie learne and yet withal be merry." The toast they drank in tankards of meade was proposed by Louis B. Wright, director of the Library: "To learning without gloom, pomposity, and pedantry. May all solemn asses go drown themselves in the unpurified Potomac."

. . . to give meaning

Audiovisual people in education may be imprisoned more tightly in their own quest for new communications techniques than in an iron mask designed by print-minded despots. The essence of communication is to escape from the grasp of a situation—to hold it at arm's length; to study it as an entity worth examination; to report its subtleties, contradictions, to relate it to other categories, to bounce it like a ball upon the walls of many tensions and challenges, to ask questions of it and get answers, to assess, to evaluate those answers—in sum, not only to observe and report but to interpret, to give meaning, detect schemes and patterns—utimately to reconstruct universes of experiences.—*Robert Lewis Shayon,* addressing the 1961 DAVI Convention. (*Audiovisual Instruction,* June 1961, p. 245.)

THE ROLE OF AUDIOVISUAL ASSOCIATIONS IN INTERNATIONAL RELATIONS

Paul S. Welty

Dr. Welty is assistant secretary general of the World Confederation of Organizations of the Teaching Profession. This article is an edited, updated version of the speech he delivered at the 1961 Annual Convention of the Department of Audiovisual Instruction, National Education Association. Following that speech the DAVI International Relations Committee passed a motion asking the DAVI Board of Directors to explore, through NEA, ways of closer cooperation with WCOTP.

We in Wcotp are convinced that audiovisual associations such as the Department of Audiovisual Instruction have a responsible role to play on the international scene. Being an international body, we are particularly interested in bringing the benefits of audiovisual instruction to areas of the world where it is little used or known, and in communicating to all teachers what is being done in this field. We have attempted to implement in a modest way this last interest by issuing recently two publications. The Summer 1961 issue of *Panorama* (Vol. III, No. 2) features "Audio-Visual Media and the Teacher." One of our other publications, *Audio-Visual Aids for International Understanding* contains information regarding films, filmstrips, slides and records in 36 countries, and a directory of sources of audiovisual aids in 60 countries. We would like to do more in this field and this is one of the reasons for my appeal to you.

The audiovisual profession has at this time not only a magnificent opportunity to test its collective knowledge and existing techniques but also, perhaps more important for the future, a chance to apply new techniques and acquire new knowledge while at the same time assisting in the educational development of emerging countries. The knowledge and skills embraced within DAVI are desperately needed in some parts of Asia, Africa, and Latin America. Certainly there is a need for continuous and systematic contact with those working in this field around the world. We would all agree that one effective way of meeting these needs is through the international work of AV associations.

Adapting AV Abroad

In seriously considering your international obligations and the work you want to do, you must learn, among other things, something of the problems of teachers and education in Asia, Africa, and Latin America. Let us take Africa specifically. While we know that traditional European concepts of education have been responsible for the development of education in both the French and English-speaking areas of Africa, these concepts are now being questioned. Although appreciated for their past usefulness, they are recognized now as being totally inadequate for servicing the future needs of the African countries. Thus in the case of Africa, European and American concepts in the audiovisual field must also be reexamined to see if they are actually benefiting the majority of the interested African public.

Needs in Africa

Let me quote a moving statistic from Africa: WCOTP has determined that over 90 percent of all the teachers in Africa are trained only to primary level with one or two years of formal teacher training. This is another challenge I present to you. How do you make this group better teachers? Do you send them all to the United States? To the United Kingdom or India or elsewhere to school? Do you build school buildings and teach the teachers for two or four years? Or do you bring the world's resources to them and help adapt them to local needs?

Instead of talking about generalities in Africa, let us look into a situation of direct importance in a country very much in the news—Nigeria. Read *Investment in Education—the Report of the Commission on Post School Certificate and Higher Education in Nigeria* (Lagos: Government Printer, 1960). This is a unique document likely to pave the way for similar studies in less developed areas. Better known as the Ashby Commission Report, it is the result of farsighted sponsorship by the Carnegie Corporation of New York. The Commission investigated in a thorough and systematic way the manpower needs of Nigeria over the next several decades. Located on the west coast of Africa with a population of close to 40 million, Nigeria is one of the largest of the former British territories now independent. What is unique about the Ashby Commission Report is that it is not bound up in the traditional concepts of education long known to Nigeria, but rather it exercised the minds of its nine English, American, and Nigerian members, resulting in a futuristic, bold look at Nigeria in the coming years. The recommendations go beyond the income adjudged to be available at the end of one or two decades, and state frankly that this is the pathway of Nigerian development; it will cost a great deal of money but there is no compromise with excellence.

I want in particular to bring to your attention Chapter 7 of the report which is entitled "A Note on New Educational Techniques" and which deals with such topics as instruction in speech, silent and sound movies, radio, and television. It lists the advantages and disadvantages of these techniques and presents a number of recommendations. The last paragraph opens the door to the audiovisual profession and invites it to interest itself more than casually in the audiovisual needs of a country like Nigeria. It recommends the establishment of a com-

mittee by the Federal Ministry of Education to study advances in these fields and to make recommendations for experiments in Nigerian schools, but, more important, the Ashby commission closes the chapter with this invitation: ". . . since these approaches are new to Nigeria and indeed relatively new to all countries, this committee is of first importance. It might be well to invite experts in these various fields from abroad to make surveys of their possibilities in Nigeria and also to make estimates of cost."

Unusual Problems

There are so many challenges facing the audiovisualist in this world. What more can be done to teach English as a second language in French-speaking areas of Africa and Asia and, for that matter, in teaching French as a second language in English-speaking areas of the world? What is being done to amass, catalog, and adapt the world's best film and audiovisual techniques to improve classroom teaching performances in science, languages, social science, and the arts? What ways are being devised to bring audiovisual instruction and techniques to teachers where there is no electricity and probably will not be for some time? I don't know how many of you are familiar with the Harvard-Arlington Language Van which was designed to bring audiovisual techniques to the most remote part of Africa, Asia, or Latin America, wherever there is a road, regardless of the source of power. It would be a pity if such techniques were to be caught up and strangled in academic rivalries while less fortunate teachers and pupils were crying for our assistance and our ideas.

I must, however, sound a warning note. As DAVI intensifies its international program, it will require a great deal of work from some of your members, and understanding and support from the others. Your energetic and dedicated members will find it most difficult to carry out an international program if the majority of the association has no appreciation for what is being done. Of course, your international work will be carried on primarily through one or more committees, but you will need to make your entire membership realize their international obligations if you are to gain their support.

Teaching Profession's UN

As DAVI explores ways of closer cooperation with WCOTP, all DAVI members will find it helpful to learn more about this world-wide organization of nearly five million members. It has frequently been described as the UN of the teaching profession. In addition to its headquarters at 1227 Sixteenth Street, N. W., Washington, D. C., it has other offices in Paris, London, Accra, New Delhi, and Tokyo. The Paris office handles our UNESCO affairs and some of our European business; the London office deals mostly with the Commonwealth countries and receives dues from the sterling area. The Ghana and India offices handle the African and Asian program respectively, and the Japanese office concerns itself mostly with Japanese publications.

The president of WCOTP is Sir Ronald Gould of England; the vice president, S. Natarajan of India, and the secretary general, William G. Carr.

The aims and purposes of the organization are: (a) to foster a conception of education directed toward the promotion of international understanding and goodwill; (b) to improve teaching

methods, educational organizations, and the training of teachers; (c) to defend the rights and the material and moral interests of the teaching profession; and (d) to promote closer relationships between teachers in different countries.

The Confederation was created August 1, 1952, in Copenhagen as a result of an agreement among the International Federation of Teachers Associations (IFTA), the International Federation of Secondary Teachers (FIPESO), and the World Organization of the Teaching Profession (WOTP). Within the framework of the Confederation, the two former federations keep an autonomy in matters concerning their specialized spheres, but the Confederation represents their member associations collectively in matters affecting education and the teaching profession generally.

Assemblies of the Confederation have taken place in Oxford (1953), Oslo (1954), Istanbul (1955), Manila (1956), Frankfurt (1957), Rome (1958), Washington (1959), and Amsterdam (1960). These assemblies are usually convened during the last part of July or in August. Themes discussed by the annual assembly the past three years have been "Public Support for Education" (1958); "Teaching Mutual Appreciation of Eastern and Western Cultural Values" (1959); and "Child Health and the School" (1960). The theme in New Delhi this year was "Education for Responsibility"; next year's in Stockholm will be "Education in a Technical Age."

Regional Conferences

WCOTP also convenes regional seminars and conferences. In 1958 an Afro-Asian conference of educators was held in Colombo, Ceylon, attended by delegates and observers from 25 countries in Asia and Africa. In 1960 Asian and African regional conferences were conducted in Malaya (Kuala Lumpur) and Uganda (Kampala). The Asian conference was attended by 154 participants from 20 countries and the African conference by 81 participants from 20 countries. In 1961 WCOTP scheduled leadership training seminars for Asia and Africa in the Philippines (Manila) and Sierra Leone (Freetown). In 1959, in conjunction with the 8th Assembly of Delegates, WCOTP held a Latin American seminar in Washington, D. C., with 40 participants from 18 countries.

WCOTP maintains permanent committees for Asia and Africa; these have met regularly since 1958, both within their regions and at the site of the Assembly of Delegates. A Committee for the Americas, initiated in 1959, held its first meeting in San José, Costa Rica in 1960.

Regional Committees

WCOTP regional committees are the operational arm of the Confederation in their respective regions. With a view to considering detailed questions relating to educational policy within the regions of Africa and Asia, WCOTP has established the Commission on Educational Policy for Africa and the Regional Council for the Study of Educational Policy in Asia. Both comprise members who have wide experience in educational problems and situations within these regions and who reflect the diversity of interests concerned. The African Commission has met on three occasions since 1958; the Asian Regional Council met for the first time in Kuala Lumpur in 1960.

The primary result of these regional activities has been the strengthening of national teacher associations, both professionally and organizationally. The promotion of national health programs,

improvements in salary negotiations machinery, increased emphasis in the curriculum on teaching about the United Nations and the development of international understanding, promotion of inservice training programs—all of these and many other national programs have resulted from international activities promoted by WCOTP.

International Level

Among achievements at the international level itself have been surveys such as that currently in progress on the Status of the Teaching Profession in Africa (being carried out on a full-time basis over a nine-month period by S. H. M. Jones of Gambia), the establishment of the education policy commissions mentioned above, the publication by the WCOTP Asian Office of a *Directory of Teacher Organizations in Asia, Australia and New Zeland,* and *a Handbook of Education in Asia, Australia and New Zealand (1960).*

WCOTP has consultative status with the Economic and Social Council of the United Nations, UNESCO, and FAO, is a member of the NGO committee of UNICEF, and works closely with other specialized agencies of the UN family.

Specialized Committees

WCOTP currently maintains five specialized committees in the fields of adult education, rural education, technical and vocational education, and new committees in the fields of science teaching and audiovisual instruction. In other fields—health, physical education and recreation, teacher training, and reading —WCOTP works with the international members concerned. Studies, surveys, and projects realized by these and former committees and by international members include:

- *Education for Children in Rural Areas* (Part I published in 1960; Part II completed in 1961)
- *Technical and Vocational Education—Organization and Status* (revised edition to be published in 1961)
- ICHPER's report on its Amsterdam 1960 Congress (including papers on Child Growth and Development, Physical Education's Contribution to Education, Child Health and the School)
- *Education for Teaching* (a brochure covering 19 countries prepared by ICET members, individual and organizational)
- Four educational editors workshops
- *Editor-to-Editor* (the report on the fourth of the editors workshops published in 1960)
- *Handbook for Editors of Educational Journals* (1961)

Other Publications

WCOTP's most important publication is *Panorama: Teaching Throughout the World,* a quarterly magazine published in English, French, Spanish, and Japanese. Among special issues published have been "Education in Africa," "Teaching Mutual Appreciation of Eastern and Western Cultural Values," "Child Health and the School," "Some Aspects of Teaching in Latin America," "Education for Responsibility," and "Audio-Visual Media and the Teacher."

Echo, a monthly news bulletin, is published in the same four languages with plans also for an Arabic edition. The *Directory* of national member associations was published for the first time in May 1961. *Annual Report,* published

in English, French, and Spanish, contains a summary of the proceedings of the Assembly, membership and attendance lists, and the major reports presented to the Assembly. Topics covered in *Theme Reports* (the national reports and syntheses presented to the Assembly) are: Parent-Teacher Cooperation (1953); Education for Teaching (1954); Status of the Teaching Profession (1955); The Teacher and the Well-Being of Society (1956); Shortage of Teachers—Causes and Remedies (1957); Public Support for Education (1958); Teaching Mutual Appreciation of Eastern and Western Cultural Values (1959); Child Health and the School (1960), and Education for Responsibility (1961).

WCOTP has also issued several publications to improve teaching methods and a service to teachers. *A Reading Guide to Asia for Teachers* is a highly selective listing of books dealing with the history and cultures of lands and peoples in the geographical arc from Japan to Pakistan. *Your Friends in Japan* is the first in a series of booklets to enable children in one country to know how children in other countries live. Finally, there is *Audio-Visual Aids for International Understanding*, mentioned earlier.

The WCOTP program for 1961-62 embraces:

- Status surveys, leadership training seminars, and inservice programs
- Exchange services (including fellowships)
- Cooperation between teachers in specialist fields
- An expanded program of publications (both in terms of spread of languages and variety of service publications to teachers)
- Study and research on the 1962 theme "Education in a Technical Age"
- Continued cooperation with the United Nations and specialized agencies —UNESCO in particular.

Further details of future plans are presented in the comments of WCOTP on the Program of UNESCO for 1963-64.

WCOTP Membership

Membership is open to any national association of the teaching profession whose constitution contains nothing contrary to the WCOTP constitution. We now have 120 national associations in 73 countries.

Regional or local teachers' associations are eligible for associate membership; however, applications must have approval from the national association in the applicant's country, if one exists. Universities, colleges, and societies for the scientific study of educational problems are also eligible under the same conditions. Associate members are found in Australia, Brazil, Japan, Pakistan, Peru, the Philippines, Uruguay, and the United States.

Specialized international educational organizations may affiliate with the Confederation as international members, retaining their identity as international bodies. They pay dues and enjoy privileges on the same basis as associated members. Present international members are the International Council on Health, Physical Education and Recreation (ICHPER), the International Council on Education for Teaching (ICET), and the International Reading Association (IRA).

The structure of the organization is as follows: The Assembly of Delegates, consisting of delegates appointed by the

national affiliates, meets every year to elect all officers except the secretary general who is appointed by the Executive Committee.

The Executive Committee consists of a president, vice president, seven members elected in rotation according to a geographical table, one member appointed by the primary teachers' federation and one by the secondary teachers' federation. It controls the administration and finances of the Confederation and prepares the agenda for the Assembly. It also submits to the Assembly reports on activities and finances and a proposed program.

WCOTP sees the problems among teachers and pupils all over the world. We do not have the solutions to all the problems but we have ideas and we know that professional associations like DAVI have more ideas. Most important, we must recognize the necessity of utilizing and adapting the educational resources in this and other countries to meet the challenges everywhere. I believe that DAVI can play a vital role in meeting this tremendous educational challenge.

Notes and Comment

WCOTP may well prove to be a new landfall in DAVI's exploration of ways to participate internationally in the field of audiovisual education. One of the most telling arguments for DAVI to accept Dr. Welty's challenge is found in the fact that DAVI's parent organization, The National Education Association, is deeply interested in WCOTP. Space does not permit the many quotations expressing this interest. A case in point is William G. Carr's article in the Fall 1960 issue of *World Affairs* (reprints available from WCOTP).

To further orient oneself to the matter of DAVI-WCOTP cooperation, see "A Proposal for International Audiovisual Exchange," by Edgar Dale in AV COMMUNICATION REVIEW for July-August 1960 (Vol. 8, No. 4). Also pertinent are: "DAVI International?—A Convention Postscript" in *Audiovisual Instruction* for April 1960; "Project Committees Air Plans for 1960-61," *Audiovisual Instruction*, June 1960, page 178; and "International Relations," *Audiovisual Instruction*, June 1961, page 280. —*D.E.S.*

. . . *against pretentious verbiage*

> You have only to go to the great philosophers to see that it is possible to express with lucidity the most subtle reflections. . . . People often write obscurely because they have never taken the trouble to learn to write clearly. . . . Often you can only guess at their meaning. . . .
>
> Another cause of obscurity is that the writer is himself not quite sure of his meaning . . . and it is natural enough that he should not find a precise expression for a confused idea. . . . But this sort of obscurity merges very easily into . . . willful obscurity that masquerades as aristocratic exclusiveness. The author wraps his meaning in mystery so that the vulgar shall not participate in it. . . . But this kind of obscurity is not only pretentious; it is short-sighted. For time plays an odd trick. If the sense is meager, time reduces it to a meaningless verbiage. . . .
>
> From *The Summing Up*, by W. Somerset Maugham. New York: Penguin Books, Inc., 1946. p. 21-3.

■ PROGRAMED INSTRUCTION

Hughes, J. L.

The Effectiveness of Programed Instruction: Experimental Findings for 7070 Training. Poughkeepsie, New York: Applied Personnel Research Corporate Staff, International Business Machines Corporation; January 1961. 26 p.

Purpose: To compare the effectiveness of programed instruction with conventional classroom instruction in the 7070 training course for customer engineers.

Procedure: The first 15-hour segment of the training course was programed in textbook form. Six experimental classes totalling 70 men, and two control classes totalling 42 men were used. A student questionnaire was administered.

Results: The time needed to present the subject was reduced 27 percent from 15 hours to 11 hours. The programmed instruction group made a 10 percent higher learning score, and had less dispersion of scores. The questionnaire response indicated that 87 percent liked programed instruction better than conventional instruction. The research staff concluded that programed instruction would decrease the time trainees spend at a central education center, and eventually would permit decentralizing of teaching to branch offices at a substantially lower cost. —*L. Twyford*

■ TEACHING MACHINES

Eigen, Lewis, D., and Komoski, Kenneth.

Automated Teaching Project. New York City: Collegiate School, 241 West 77th Street; June 1960. 27 p.

Purpose: To investigate the relative effectiveness of teaching machines and programed textbooks; also to learn the effect of grade level on learning by these automated teaching methods.

Procedure: A total of 74 students in the ninth, tenth, and eleventh grades participated in the study. The machines were Skinner-type, write-in models, and were placed on individual desks in a special room. Presenting questions and answers on separate pages, the programed textbooks were mimeographed, and were used in regular classrooms. The program, *Sets, Relations, and Functions* by Lewis D. Eigen, consisted of 707 frames. Students were randomly assigned to teaching machine or programed texts at each grade level for two 30-minute periods daily. Records of actual learning time were kept. A 30-item test and an attitude test were administered at the conclusion of the program. Analysis of variance was used in evaluation of data.

Results: Learning took place with substantially equal efficiency by machine and programed text. The mean for the machine group was slightly lower than the mean for the programed text group. Since the machine group encountered mechanical difficulties and took 37 minutes more time, the researchers concluded that the mechanical devices hindered learning. The mean attitude score of the programed

text group was more positive than that of the machine group. There seemed to be no significant effects of grade level on learning. —*L. Twyford*

Rothkopf, Ernest Z.

"Automated Teaching Devices and a Comparison of Two Variations of the Method of Adjusted Learning." *Psychological Reports:* 163-69; February, 1961.

Purpose: Two techniques of adjusted learning were compared. Plan one eliminated a paired associate after one correct response until the whole eight item sequence was learned. This process was then repeated. Plan two required two correct responses of each item before it was dropped. Thus, both plans required two correct responses as might be required in a teaching machine.

Procedure: 100 airmen were divided into two experimental and two control groups. A pre-test on paired associate learning was later used for analysis of co-variance. In the paired associates, the stimulus was the picture of a machine object; the required response, a letter of the alphabet. These were presented manually.

Results: No significant differences were found between the two methods. It was theorized that the method employing plan two (two correct responses immediately) would require a more complex automatic trainer. The author cautions against generalizing to all automated instruction because of the possibilities of the factors of the type of stimulus, type of response, criterion for mastery, and length of list.—*Paul R. Wendt*

Row, Arnold and others.

Automated Teaching Methods Using Linear Programs. Los Angeles: Department of Engineering, University of California, 1960. 57 p.

Purpose: To investigate the basic properties of auto-instructional systems.

Procedure: Multiple-choice teaching machines, free-response teaching machines, programed texts requiring responses and giving correct answers, programed texts with no responses or answers, programed lectures, and standard lectures were compared in this experiment. The subjects were 186 freshman engineering students who were randomly divided into seven sections. Analysis of variance was used to compare the results of the locally-constructed achievement tests.

Results: All programed methods proved to be significantly better than the standard lecture in achievement, but there were no significant differences in achievement among the programed methods. The programed lecture required the least amount of time; the machines, the longest. Overt responses followed by immediate feedback did not increase learning, yet required more time. This result implies that more investigation of the reinforcement theory of learning is needed. The programs rather than the hardware seemed to be the more important factors in the machines, although one aspect of the study questions the sequential construction of programs. —*R. Brown*

Shay, Carleton B.

"Relationship of Intelligence to Step Size on a Teaching Machine Program." *Journal of Educational Psychology* 52, No. 2: 98-103; April, 1961.

Purpose: To determine if there is a relationship between intelligence and step size in a teaching machine program for each of the following criteria: total learning of rote materials, learning of materials involving understanding, errors, and time to complete the program.

Procedure: Item step size was defined as "the difficulty of giving the correct answer," measured by the number of errors made on a program. Three programs were written for a fourth grade unit in Roman numerals. All three were revised for average probability of correct response of 90 percent—one for students with IQ above 110; one for IQ between 90 and 109; one for IQ below 89. The pre-test score was used as a co-variate in analysis. The subjects were 90 fourth grade pupils in four Los Angeles elementary schools; they were chosen on the basis of pre-test and group intelligence scores. Some items in the programs were rote items and some required understanding.

Results: None of the differences were significant except the percentage error score. The author concludes that if there is a relationship between intelligence and step size, it is not a strong one. Therefore, alternate programs are not necessary on the basis of ability alone. —*Paul R. Wendt*

Smith, Edgar A., and Quackenbush, Jack.

"Devereux Teaching Aids Employed In Presenting Elementary Mathematics In A Special Education Setting." *Psychological Reports,* 7:333-36; October 1960.

Purpose: To study the value of multiple-choice teaching machines to provide supplemental instruction in mathematics to a group of slow learners—mean IQ 77, mean chronological age 17.7.

Procedure: Arithmetic problems were presented in a workbook resting on a machine with two rows of push buttons. Several students could share a machine at one time. Each indicated answers by depressing a button adjacent to his selected response. Correctness was verified by a buzzer sound. Gains indicated on the California Achievement Test were compared with gains in other academic areas and with gains by similar students for the previous year. The special instruction continued for a year.

Results: The mean arithmetic growth in the previous year was .19 of a grade level. Mean growth in other academic areas was .25 of a grade level. Mean growth in arithmetic during the experimental year was .51 of a grade level. The researchers concluded that the teaching aids were useful in promoting academic achievement and better motivation. —*L. Twyford*

■ TELEVISION

Merrill, I. R., and Montgomery, D. E.

Evaluation of "Food For Life," a Televised Series on the Principles of Nutrition For Homemakers. WKAR-TV Research Report 591M. East Lansing: Department of Television Broadcasting, Michigan State University; August 1, 1959. 24 p.

Purpose: To discover whether the television series "Food For Life" was presenting material at the proper level of difficulty, whether it sustained interest, and whether it had more appeal to the overweight viewer.

Procedure: Questionnaires were mailed to two groups of viewers. One group comprised 52 professional home economists; the second, 45 women without a college degree in home economics. The respondents indicated whether they were learning, and their interest in the program.

Results: Women viewers reported they learned as much as they would have from reading a book on nutrition. A majority of the viewers saw fewer than one-half of the programs of the series. The series did not have more appeal for overweight women. —*L. Twyford*

Reiner, Walter.

A Survey of TV Viewing by Seniors in the Top Quarter of Their Class and Seniors in the Lowest Quarter of Their Class. Pearl River, New York: Pearl River High School; July 6, 1961. 4 p.

Purpose: To ascertain whether there were differences in the television-watching patterns of seniors in the top and lowest quarter of the class. Did they spend too much time as TV viewers?

Procedure: A brief questiannaire and a survey form were developed. Daily, the students listed on the survey form the TV programs they had seen the previous day, and reported the time thus spent. They completed the questionnaire at the end of the week. The evaluation was made in June.

Results: It was learned that students in the two groups spent the same amount of time watching television—an average of 30-minutes daily. Students in the top quarter watched a wider range of programs. Those in the lowest quarter watched crime, detective, and cowboy shows. Of the top-quarter students, 70 percent engaged in other activities while watching, but only 34 percent in the lowest-quarter followed this practice. These activities included reading, writing, sewing, and setting hair. Both groups stated that westerns, crime shows, and quiz programs should be reduced.

—L. Twyford

Evans, Richard I., Wieland, Betty A., and Moore, Charles W.

"The Effect of Experience in Telecourses on Attitudes toward Instruction by Television and Impact of a Controversial Television Program." *Journal of Applied Psychology* 45, No. 1: 11-15; February 1961.

Purpose: To investigate (a) to what extent a single controversial educational television program would change viewers' attitudes; (b) how previous experience with telecourses would affect students' attitudes toward television instruction as contrasted with traditional classroom instruction.

Procedure: The subjects were 160 students enrolled in five sections of introductory psychology at the University of Houston. Four social-psychological measures were taken by the Evans-Quasi-Role-Playing Device, the Osgood Semantic Differential, the Ethnocentrism Scale, and a personal data sheet including another application of the Osgood Semantic Differential. The experimental groups were shown the television program *Roots of Prejudice* on closed circuit television. This was a 30-minute film challenging the validity of racial and religious stereotyping. The difference between the pre-test and the post-test on the four measuring devices measured a change of attitude caused by the film.

Results: The control and experimental group compared by Wilson's distribution-free test of analysis of variance showed no significant differences—whether or not the students had previous experience with telecourses. When both groups were broken down into high prejudice and low prejudice groups, the low prejudice group did show a change toward the median. The tests also showed that the TV-experienced group favored the classroom lecture over the TV, but further analysis showed that the grades received in the TV courses might have been an important factor.

—Paul R. Wendt

Research Abstracts and Analytical Review

of Completed Projects: National Defense Education Act, Title VII

INSTALLMENT 2

PUBLISHED BY THE DEPARTMENT OF AUDIOVISUAL INSTRUCTION
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Ten Recent Title VII Reports: A Perspective

A. W. VANDERMEER

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THE INITIAL INSTALLMENT of *Research Abstracts and Analytical Review* summarized the first 16 completed projects financed by the federal government under the provisions of the National Defense Education Act, Title VII.[1] It also provided a general summary and discussion of the status and trends of 137 similarly-supported research studies in educational media.

This essay will review somewhat more intensively the ten recent research reports that are abstracted in this issue. Of these studies, eight have relevance to educational television, one concerns magnetic recordings and visual displays, and one is largely related to information storage and retrieval. The current sample of studies is significantly different from the body of Title VII projects[2] in two respects: A greater proportion of this sample is devoted to television than is the case with the total body of the studies, and most of the ten studies have produced statistically significant differences between experimental and control groups.

Media Information Center

Who, from the most highly respected research professor to the lowliest

[1] *AV Communication Review*, Vol. 9, No. 4, July-August 1961.
[2] *Ibid.*, p. A-6 and A-11.

graduate assistant, has not felt chagrin at completing a review of literature on a topic only to find that somehow one or more important pieces of work have escaped his attention? Tauber and Lilley have completed an imaginative and thorough study that shows precisely what the odds are in favor of locating 100 percent of the relevant publications on a given aspect of research in newer educational media.[3] The unhappy fact is, these authors report, that if one relies exclusively on the extant indices and bibliographies, the chances are that he would overlook one important article for every five he would locate.[4] Their method of research was beautiful in its simplicity and precision. W. H. Allen's bibliography of 330 articles, monographs, and other publications was designated as a standard; then some two dozen indices and bibliographies were checked to determine whether they made reference to each entry in the standard list. Of the sources checked, the National Union Catalog of the Library of Congress listed less than half of the monographs in the sample; *Education Index* included about 85 percent of the journal articles on the standard list, but less than one-third of the monographs.

In view of their findings, Tauber and Lilley recommend the establishment of a comprehensive information service at a national level to provide workers in the field of educational media with complete bibliographical information on research completed and in progress. They further recommend that the Media Research Information Center be located in the Educational Media Branch of the United States Office of Education. In line with that recommendation, a pilot research information service has already been established under Part B of Title VII at Western Reserve University. (For full details, see *AV Communication Review*, Vol. 9, No. 5, 1961, p. 88.) This information retrieval service may be brought into USOE, it was recently stated by Seth Spaulding, Chief of its Educational Materials and Services Section, Educational Media Branch. He added, "It is logical for the Office of Education to operate such an informational service."

The arguments of Tauber and Lilley favoring participation by the federal government in such a facility are potent, but the recommended method of this participation is perhaps more debatable. My own bias

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[3] Tauber, Morris F. and Lilley, Oliver L. *Feasibility Study Regarding the Establishment of an Educational Media Research Information Service.* New York: School of Library Service, Columbia University; 1960. (Contracted by USOE as a dissemination study under Part B of Title VII.)

[4] *Ibid.*, p. 43.

is that such an information service might best be administered and operated by a university under federal subvention on a long term continuing basis. There are many reasons why such a facility would be more appropriately placed in a university, but nearly all of them stem from one central fact: knowledge and scholarship are the primary concern of a university, whereas, at best, they are a secondary purpose in government. The ramifications of this principle for the general administration of a research information facility, for the kind of professional personnel that it could attract and maintain, and for its acceptance in the educational world from which it would derive its principle support, are far-reaching.

Low Cost Instructional Aids

Seeking partial substitutes for "in-person" instruction, C. R. Carpenter and his associates in the Instructional Film Research Program of Pennsylvania State University several years ago developed and validated a body of techniques for the production of inexpensive instructional films, utilizing the bare minimum of equipment and the most austere production methods. Motion pictures produced in this manner proved to be highly effective instructional tools.[5] The same general idea utilizing tape recordings and displays of posters was recently tested by Roland E. Johnston, Jr. of Drexel Institute of Technology.[6] He compared the effectiveness of a psychology course taught by conventional lecture-discussion methods with the same course taught by tape-recorded lectures supplemented by posters that an assistant displayed at appropriate points. The recorded presentations were followed by periods of discussion led by competent academic personnel. The negative results of Johnston's study were not so marked with respect to measures of actual achievement as they were with respect to measures of student attitudes. This finding, and an analysis of the collected comments of students, would tend to support the conclusions of previous research: prestige of medium and student perception of the reliability of the information source are factors which exert a significant influence on learning. Perhaps the most disappointing of Johnston's findings is that approximately only one student in fourteen made any outside-of-

[5] Greenhill, L. P. *A Study of Feasibility of Local Production of Minimum Cost Sound Motion Pictures.* Special Devices Interim Project 20E-4. Port Washington, New York: Special Devices Center, 1955.

[6] Johnston, Roland E., Jr. *Magnetic Recordings and Visual Displays as Aids in Teaching Introductory Psychology to College Students.* Philadelphia: Drexel Institute of Technology, 1961.

class use whatever of the 22 tape-recorded lectures available for their individual review and study. Only three of the 187 students in the experimental sections used the tapes for review, and only ten more used them to make up lectures that they had missed; the remainder used them not at all. The reasons for this surprisingly low incidence of use are not made clear. Perhaps the tapes were inconvenient to obtain or to listen to, or perhaps the idea of using tapes was simply too unfamiliar, or perhaps alternative means whereby the student could direct his own selection of content and rate of progress for review purposes were available and preferred.

The actual observed difference as measured by achievement tests in Johnston's experiment was about three percent. On the other hand, Johnston states that his experimental method could reduce student-teacher contact by one half.[7] Taken in juxtaposition, these statements would seem to indicate that, while the statistical significance of Johnston's findings may be marginal, the practical significance could be rather great. Certainly, the technique he developed and employed as the experimental method is worthy of continued study.

Johnston's study—in addition to revealing student attitudes that were highly unfavorable toward the experimental educational media he used—showed that the media produced differences in achievement which were either statistically nonsignificant or significant in favor of conventional media. In contrast to these results, the television research program of Hunt produced data that favored the newer medium at a statistically significant level with respect to attitude, opinion, and overt behavior, but did not yield any statistically significant differences with respect to the achievement of students.[8] Actually, to compare the two studies in this way is not exactly fair since the experimental subjects in Hunt's research were teachers of reading and parents of elementary school children, rather than students in the ordinary sense. In terms of all of the criterion measures applied, the attitudes of both target audiences—as measured by paper and pencil tests—and the teachers' behavior as measured by observations were significantly changed as a result of viewing some fifteen televised demonstration lessons in the teaching of reading. The teachers actually taught reading in a distinguishably different manner after viewing the television series. Unfor-

[7] *Ibid.*, p. 52.

[8] Hunt, Lyman C., Jr. *An Experimental Project Appraising the Effectiveness Of A Program Series on Reading Instruction Using Open Circuit Television.* University Park, Pennsylvania: The Pennsylvania State University, Department of Elementary Education; 1961.

tunately, no immediate effect of the programs on the actual reading achievement by children whose teachers viewed the televised demonstration lessons was shown. The reading achievement of children taught by teachers in the experimental group did not significantly exceed the effect in reading achievement by those whose teachers did not view the demonstrations. One would expect that changes in teaching method over a fifteen week period should produce significantly higher achievement by students if the method were related significantly to achievement. It is conceivable, however, that the results of the changed attitude of teachers and parents, and of the modified teaching methodology may bear fruit in improved reading by pupils at a later date. After all, new reading techniques and new concepts of reading instruction were introduced in the fifteenth week of the television series as well as in the first. It would be somewhat highly unlikely that all of the new ideas would have had time to exert a measurable influence on the reading skills of children by the time the series ended.

Many of the previous studies of the effectiveness of ETV have treated the influence on teachers and parents as a valuable but definitely incidental dividend when the primary purpose of the television series was to achieve a direct effect on children's learning. Hunt's research demonstrates the feasibility of utilizing television to improve the quality of teaching by making teachers and parents the primary target audience. The findings of the study are consistent with those of similar research conducted in Wisconsin and elsewhere where in-service training was the object.

Improvement of ETV: Seven Reports

The research studies of Johnston and Hunt aimed to show the effectiveness of educational media for instructional purposes, and were classified by Norberg as *comparative effectiveness* and *developmental* research. The Metropolitan Pittsburgh Educational Television Station and the American Institute for Research have, by contrast, studied certain production and utilization variables designed to improve the efficiency of ETV as established in the regular instructional program of public and private schools in the Greater Pittsburgh area. Perhaps the results of both sets of studies would have been more useful if the research concepts embodied in each could somehow have been combined. Both sets did, of course, produce worthwhile results, but both also produced data indicating lamentably low student achievement.

Learning scores attributable even to the most effective of the experimental teaching methods seldom averaged more than 50 percent. An examination of test results of the Pittsburgh studies reveals that the usual learning score was between 35 and 50 percent based on mean correct scores as a proportion of the total possible correct. The lowest mean score was only slightly more than 11 percent. It should not be assumed that the research reported here is unique in this respect; on the contrary, achievements scores ranging around 50 percent of the total score possible are the rule rather than the exception in educational media research. One sometimes feels compelled to conclude that either the tests employed do not measure learning very accurately, or that continued public support of education is largely an act of faith.

Lumsdaine and his associates have made an interesting contribution to instructional research methodology by inventing a statistical device to use as an alternative to the mean raw score as a basis for comparing learning increments. Called an *improvement ratio*, it is computed by dividing the difference in mean scores by the difference between the mean score achieved by the control group and the total score possible on the test. For example, when the mean achievement score of the experimental group is 16 on a 30 item test, and that of the control group is 12.6, the difference between the groups is expressed as an improvement ratio of 19 percent. To be able to report that the average amount of improvement attributable to the experimental method is 19 percent is considerably more optimistic than to report that, on the average, the experimental method produced 3.4 or more correct answers on a 30 item test in which the average score was only 53 percent of the total number possible. The latter means of expression, however, better points up the need for more research of the kind reported by Lumsdaine and his associates in the American Institute for Research.

These investigators have performed a series of useful research studies on the improvement of instructional television programs through the analysis of student responses. Seven of their research reports on twelve experiments are abstracted in this issue. They treat three general ideas: pre-production testing, programing the TV lesson, and classroom procedures as integrated with the television broadcast. Criterion measures included paper and pencil tests of conceptual learning, attitudes, and preferences, and behavioral measures of participation in out-of-school learning activities.

The positive findings of the research related to student learning of

concepts and principles are that television programs can be improved by pretesting them, and by building into them the requirement that the viewing student make active, overt responses to their appropriately spaced stimuli. It was further found that when the person performing the science demonstrations over television was an age-mate of the viewers, more interest in repeating the demonstration at home was manifested than when the demonstrator was an adult. Yet students increased their interest in science as a career when they saw an adult demonstrating science experiments. This latter difference is almost exclusively attributable to the reaction of girls to the sole adult male demonstrator involved in the comparisons. A final conclusion is that students preferred both to watch and to engage in experiments that were completely demonstrated on the television program, and for which the necessary materials were readily available, rather than those demonstrations that were stopped short of completion, and those for which they could obtain the materials only at some expenditure of time and effort.

The findings of Lumsdaine and his associates as to the efficacy of pre-production testing are as useful as they were predictable. Previous research studies have shown that tryouts of preliminary versions of motion picture and television productions on audiences similar to those to which the finished productions will be directed can help the producer to avoid errors of omission and commission; frequently, also, the pretests save a considerable amount of money by proving the effectiveness of relatively simple and inexpensive production techniques.

Considerably more revealing, though perhaps no more unexpected, is the evidence the research provides concerning the great difficulties encountered in gearing instructional television programs effectively to audiences that are highly heterogeneous in learning ability. In one experiment, for example, the investigators found that the difference in mean achievement scores between experimental and control groups for high IQ students was 12 percent or 4.9 points, whereas the difference between the experimental and control groups for low IQ students was only .2 points.[9] It would appear that this research—and other such research currently under way—which seeks to apply concepts of auto-

[9] Gropper, George L. and Lumsdaine, Arthur A. *An Experimental Comparison of a Conventional TV Lesson with a Programmed TV Lesson Requiring Active Student Response.* Pittsburgh: American Institute for Research, 1961. p. 9. *Note:* For full bibliographical data on any of the Pittsburgh studies which footnotes of this essay briefly identify, see title lines of the abstracts published under *Televised Instruction: Seven Reports,* p. A-48, this issue.

mated instruction specifically requiring active responses by viewers is likely to result in only partial improvement of televised instruction.

While the results of the programed television instruction that Lumsdaine and his associates investigated were perhaps not all that they may have hoped for, television programs requiring active student response during the viewing and designed to anticipate and to provide for such responses consistently proved superior to programs not requiring such responses. When students were required to make such responses to programs not specifically planned to elicit them, positive results were not found. This finding is consistent with that of related research such as the study by Ash and Carlton on the value of note-taking during film learning.[10]

Of considerable importance, in addition to what the Lumsdaine investigators discovered about successful techniques for producing and using ETV, are those techniques found not to produce significant differences in the learning of the experimental group. Among these were the construction of active responses when compared with the repetition or reiteration of the proper response by the instructor, intermittent confirmation of correct responses when compared with other active responses by students, competition with a presumed studio audience when compared with the absence of such competition, and the use of a question mark compared with the use of a triangle to indicate when the student should make an active response. The authors do not take their finding of nonsignificant differences as necessarily conclusive, but rather opine that perhaps the experimental conditions were not conducive to the revelation of the true effects of the variables.

Central to the series of studies reported by Lumsdaine and his associates is the concept of programing as it applies to televised lessons. The general principles of programed ETV are stated in the fifth of the studies.[11] The principles of programing applied in the experimental versions of televised lessons included (a) the reduction of lesson content to small steps, and the logical sequencing of these steps, (b) the encouragement of active student response at each step, followed by knowledge of results (reinforcement), and (c) the preliminary tryout of the broadcast to determine the probability that the programed lesson

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[10] Ashe, Philip and Carlton, Bruce J. *The Value of Note Taking During Film Learning.* University Park, Pennsylvania. Instructional Film Research Program, College of Education, The Pennsylvania State University, 1951.

[11] Gropper, George L. and Lumsdaine, Arthur. *Issues in Programming Instructional Materials for Televised Presentation.* Pittsburgh: American Institute for Research, 1961.

can elicit correct active responses at each step. The full impact of the definition implicit in this description of programing can hardly be understood without a rather thorough examination of the scripts of the experimental and control lessons. For emphasis, one example may be justified. An item on the criterion test reads: "We can break a molecule of water into two atoms of_____ and one atom of_____." In the experimental programed script, the following passages appear:

When water freezes and turns to ice, nothing happens to the H_2O molecule. It remains the same or?/*intact*. Or when ice melts and turns back into water, nothing happens to the H_2O molecule, it is the same as before; the molecule remains the same or?/*intact*. This is also true when water is boiled and turns into steam, or steam is turned back into water. Nothing happens to the H_2O molecule; it remains the same or?/*intact*.)

The ?/ in the foregoing cues the viewer to respond. During the program, he is expected to fill in blanks with the word *intact* or to think actively about the word.

A little farther on in the experimental script is the following passage:

Two hydrogen atoms from hydrogen gas and one oxygen atom from the *air* would combine to form water. Thus, when hydrogen gas is burned, hydrogen atoms combine with oxygen atoms in the air, and water is formed. Also heat is released. A chemical reaction has taken place, for the molecules of hydrogen gas broke down into hydrogen *atoms* and the atoms *recombined* in new ways. They combined with oxygen atoms from the air to form water molecules. A water molecule is formed when two atoms of ?/*hydrogen* combined with one atom of ?/*oxygen*.

By contrast, the control or nonprogramed script contains these passages:

Now let's come back and take a look again . . . comparing physical changes and chemical changes. First, physical changes. I'll represent physical changes by this block of ice. A block of ice made from molecules—molecules made of hydrogen and oxygen, water. I could note this and make a change of state, or maybe I'd like to take a hammer and break the ice. I could do that, and I would be speaking about a physical change, and can you tell me why? Look. Breaking up ice. Tell me now, have I broken apart any molecules of ice? Have I broken apart any hydrogen and oxygen atoms that make a molecule of water? No, I have not. I have not changed any of these molecules of ice even though I've changed it so it can be identified now as a physical change. A physical change. Now let's stop and think some more.

One of the changes, the second kind, a chemical change. Let me represent the chemical change for you in an old familiar friend you've worked and seen before. This represents the electrolysis of water. Breaking up of water. Another kind of chemical change. Look, a container filled with water. H_2O molecules. In the water some acid so that electricity from a battery can flow through wires, these wires in tubes, but the important thing is we want to take molecules of water, made of hydrogen and oxygen, and break them apart. Divorce them from one another; you do that with electrolysis. We can take this and remove the H, the hydrogen, collect it in one tube, and from that molecule of water that we are breaking up, collect oxygen. As a matter of fact, aren't we breaking up and collecting twice as much hydrogen as oxygen when we break apart these molecules of water? I want you to keep in mind, though, when you break up molecules within a substance and have them recombine, reform, and possibly make new molecules of the same thing, this is a chemical change. We haven't destroyed

anything. There isn't any difference in weight of anything. We've just taken things and reused them in different ways.

The investigators do not report the relative proportion of students viewing the experimental television lesson and control version who passed the test item that required them to recall the composition of water, but it would be safe to predict that those who had not already learned that water is composed of two molecules of hydrogen and one molecule of oxygen would find the programed lesson of far more help to them than the unprogramed lesson. The interesting fact, however, is the multiplicity of possible variables that have been subsumed under the single term *programed*. The authors are obviously well aware of these variables, and of the possibility that they may have differential and even contradictory effects. It is to be hoped that research will be continued in this area.

This essay began with a reference to a study highlighting the need for a research information facility for newer educational media. As essential as such a facility is, it could not take the place of a thorough and detailed study *in the original* of research reports of the kind described in these pages. Every one of the ten reports dealt with here contains valuable data which could be richly rewarding both to teachers and research workers who are interested in the areas of education touched by the research. No abstracts and no critical discussion can do justice to the results of the work of these scholars whose research is so briefly considered in this essay. Each one has a significant contribution to make that goes beyond what has been reported or what could be reported in these pages. This writer devoutly hopes that the studies will have wide circulation among scholars and practitioners in the educational media field.

Title VII Research Abstracts Installment 2

William H. Allen, Editor of AV Communication Review, is the author of the ten abstracts presented here.

Tauber, Maurice F., and Lilley, Oliver L.

Feasibility Study Regarding the Establishment of an Educational Media Research Information Service. New York: School of Library Service, Columbia University; May 1960. 235 p. (Contracted as a dissemination study under Part B of Title VII; USOE Project No. B-00A; University Microfilms Pub. No. 62-144.)

Purpose: To study the problem of identifying, locating, and disseminating audio-visual media information in terms of (1) availability of current bibliographical sources, indexes, abstracts, journals, or other printed works; (2) the activities of personnel in the field as they seek information concerning research; (3) the current systems of classification employed to organize research information; and (4) the systems of subject headings that might be applied to the material.

Procedure: The consultants approached the problem in several ways: (1) The testing of current sources of information was done through the identification and locating of a sampling of research studies included in a summary of research prepared for the *Encyclopedia of Educational Research* by William H. Allen. (2) A questionnaire was used to seek information from a selected group of persons involved in various aspects of educational media. (3) The classification was developed on the basis of a detailed study of the organization of the research studies in various bibliographies, files of research study, abstracting services, and standard systems of arrangement. (4) The list of subject headings was developed in a similar way, with special attention given to existing subject heading lists. (5) The consultants visited installations where files of research studies were being accumulated, conferred with many individuals in the field, and carried on correspondence with them.

Results and Recommendations: The consultants recommended: (1) Necessary action should be taken to establish an educational media research information service in the Office of Education under the Media Branch; when the Office undertakes a comprehensive research information program, the media information service should be integrated with the larger system. (2) The media research service should be based upon a comprehensive media classification system. (3) Because reports of research relating to new educational media are not represented satisfactorily in the existing bibliographical controls, any information designed to improve the situation must: (a) represent all the new educational media concerning which research is under way, or has been conducted; (b) include references to reports of research issued by private,

commercial, governmental, and other investigating agencies; (c) be receptive to reports whatever their physical forms; (d) keep up to date in its coverage; and (e) provide access for topical searches, whether current or retrospective, by appropriate devices for subject control of the area. A detailed "Exploratory Classification Schedule for Research in Education Media and Communication" was developed, consisting of classification by four dimensions: audience facet, media facet, program facet, and research facet. A pilot research information service has been established under Part B of Title VII at Western Reserve University, Cleveland. Information can be obtained from Dr. Allen Kent, associate director, Center for Documentation and Communication Research at that university.

Johnston, Roland E., Jr.

Magnetic Recordings and Visual Displays as Aids in Teaching Introductory Psychology to College Students. Philadelphia: Drexel Institute of Technology; May 1961. 62 p. (USOE Project No. 240; University Microfilms Pub. No. 62-1078.)

Purposes: To determine how achievement in college classes taught by audiovisual presentations and discussions compared with that in classes taught by conventional methods using lectures, discussion, and laboratory work.

Procedure; Method: An introductory course in general psychology at Drexel Institute of Technology was taught by two methods: *tape-recorded lectures*—accompanied by large *posters* showing words, definitions, and diagrams—and alternating, hour by hour, with informal *discussion* of the lecture; (2) *conventional* instruction consisting of lectures, discussion, and laboratory studies. For both control and experimental classes, the course extended over a single quarter (12 weeks), but the project—which involved 18 classes—extended over four quarters. Assignment of students to sections was not controlled, but each of the four instructors taught both experimental and control sections.

Subjects: Subjects were 397 students enrolled in the College of Business Administration, College of Engineering, and College of Home Economics. They were divided into nine experimental sections.

Test Measures: Three multiple-choice tests were administered during the quarter. Near the end of the course, students in experimental sections completed a "Student Opinion Schedule" for expression of their opinion on the experimental method of teaching.

Statistics: Analysis of variance.

Results: (1) Students taught by the *conventional* method showed somewhat greater achievement than those taught by the *experimental* method. (2) Considering all students in the study, the researcher found that achievement tended to be higher among those who were older, male, enrolled in the College of Engineering or College of Business Administration, higher in verbal aptitude, and who had been in college for a greater number of quarters. (3) No significant differences were found between students taught by the two methods when they were segregated on the basis of sex, college in which they were enrolled, course they pursued, and instructor. (4) A majority of the experimental method students thought they learned less than they would have

learned through conventional instruction, and found the method less interesting; they disliked the fact that they were not able to ask questions during the recorded lecture; reported that they knew the instructor about as well as, or better than, instructors in other subjects; stated that they would not enroll in another course using the method, but found the alternating class discussions of value. (5) Principal advantages of the experimental method as the students listed them: tape-recorded lectures are better organized; more material is covered; lecture can be heard more than once; posters gave a logical outline; variety of instructors; the method saves time and money. (6) Principal disadvantages they listed: lack of class participation; little interest; impersonal atmosphere; voices were poor and monotonous; poor acoustics in the room; poor recording. (7) Only 7 percent of the students listened to the tape-recorded lectures at times other than during the scheduled presentations.

Hunt, Lyman C., Jr.

An Experimental Project Appraising the Effectiveness of a Program Series on Reading Instruction Using Open-Circuit Television. The Reading Center of the College of Education, The Pennsylvania State University; March 1961. 116 p. (USOE Project No. 309; University Microfilms Pub. No. 62-1077.)

Purpose: To determine whether or not a television series demonstrating procedures and practices pertaining to individualized reading instruction influenced teachers to incorporate such procedures and practices into their own classroom programs.

Procedure; Method: Two randomly-assigned teacher groups committed themselves *to view as many as possible* of 15 half-hour TV programs on reading instruction procedures presented on Saturday mornings. Two other teacher groups agreed to *avoid* viewing any of the series. Each teacher in one of the viewing groups, and each in one of the non-viewing groups was asked to submit a written weekly report. Members of the two other groups submitted no reports. Prior to the TV series (a) participating teachers completed a questionnaire as to their attitudes toward the teaching of reading, and a self-report on such teaching; (b) each was observed for about 50 minutes by a member of the trained observer team, who recorded the observation on a special form. Teachers not assigned to experimental groups were also administered the attitude questionnaire, and were asked to submit weekly critiques of the TV programs. Participating parents—after they had completed the questionnaire to indicate their attitude toward reading instruction—were also randomly-assigned to either a viewing or a non-viewing group. Following the TV series, each teacher in the four experimental groups was re-observed and re-interviewed, and again completed the two questionnaire forms. Similarly, the parents again completed their attitude forms. Children in Grades 3, 4, and 5 were given an attitude test, while those in the third grade were also given a reading achievement test.

Subjects: Subjects were 213 teachers of Grades 1 through 6 in the central area of Pennsylvania.

Test Measures: Three evaluation measures for use with the teachers groups were developed: "An Observation of a Teacher's Reading [Instruction]

Program," "A Teacher's Attitudes Toward Teaching Reading," and a "Teacher's Self-Report on Teaching Reading." In addition, two other measures were developed: "A Questionnaire [for Parents] of Attitudes Toward Reading Instruction in the Elementary School," and "How I Feel About Reading," a scale designed to ascertain children's attitudes toward classroom reading instruction, and toward their own reading of books.

Statistics: Analysis of variance and Barlett's test for homogeneity of variances.

Results and Conclusions: The viewing of a TV program series demonstrating classroom reading instruction: (1) had a statistically significant positive effect upon the *observed* classroom performance of the viewing teachers; (2) had a significant positive effect on *attitudes* of teachers toward the individualized approach to teaching reading; (3) had a significant effect on what teachers themselves reported they were doing in teaching reading; (4) had a significant positive effect on the *attitudes of viewing parents;* (5) but had *no* measurable effect on children's *achievement* in reading or on their *attitudes* toward reading. The writing of *weekly reports* concerning classroom and professional activities had *no* significant effect on any of the other variables studied. The final generalization is made that "open-circuit television can be used to influence the performance and attitudes of teachers and the attitudes of parents with respect to a particular educational concept"—in this instance individualized instruction.

Televised Instruction: Seven Reports

Editor's Note: The seven research reports abstracted here bear the same USOE Project Number because the studies were a series accomplished by team work of the Metropolitan Pittsburgh Educational Stations WQED-WQEX and the American Institute for Research. A. A. Lumsdaine, George L. Gropper, assistant program director of the Institute, and associates directed and reported the projects which used student responses in three ways to improve televised instruction: to pretest a TV lesson; to evaluate program adequacy and to enhance learning effectiveness; to evaluate incentive that the TV lesson created. See VanderMeer's overview of the series, p. A-40, this issue. Also see Allen's abstract, p. A-56, of Report No. 7 which summarizes the experiments.

Gropper, George L., Lumsdaine, Arthur A., and Shipman, Virginia.

Improvement of Televised Instruction Based on Student Responses to Achievement Tests. Studies in Televised Instruction, Report No. 1. Pittsburgh: Metropolitan Pittsburgh Educational Television Stations WQED-WQEX and American Institute for Research; March 1961. 67 p. (USOE Project No. 336; University Microfilms Pub. No. 62-1079.)

Purpose: To provide an experimental evaluation of the amount of improvement

that can be brought about in a televised lesson by the process of tryout and revision utilizing achievement test results.

Procedure; Method: Two different lessons—one on the effects of heat and one on an introduction to chemistry—in a junior high school science series televised by the Metropolitan Pittsburgh Educational Television Stations were shown on separate occasions to a preview audience of students. Each TV lesson was taught by a different teacher. Following the preview showing, students took an achievement test based on the lessons. Analysis of the test items revealed which points were misunderstood or poorly learned. The lessons were then analyzed to discover the possible reasons for their ineffectiveness, and were revised to remedy the weaknesses. Later, both the preview version and the revised version were telecast simultaneously (over WQED and WQEX) on the day the lesson was regularly scheduled to be shown. Students who watched each version then took an identical achievement test. This procedure was followed on separate occasions for the lesson on heat and for the one on chemistry.

Subjects: The preview group for each lesson was a class of 30 to 40, representative of those students who customarily viewed the science series at its regular time. For the simultaneous telecasts, three randomly assigned intact classes—matched for grade level and IQ to form matched pairs of classes—for the lesson on heat, and four classes in different schools for the chemistry lesson, watched the new or revised version; a similar number watched the original or preview version.

Test Measures: The achievement tests, consisting of objective items and essay questions, were designed to cover the facts and concepts listed in a statement of lesson objectives. Test results were compared to show gains due to revision of the lessons.

Statistics: A one-tail t-test was performed to measure the differences between the achievement of the two groups. The degrees of freedom employed were based on the number of matched pairs of *intact classes* sampled, and not on the number of students in these classes.

Results and Discussions: (1) Results on the objective and essay test items showed an average improvement varying from 12 percent to 26 percent for students who watched the revised versions over students who watched the original preview versions. These differences were statistically significant. (2) When the test items based on the demonstrations were analyzed separately, the students who viewed the revised versions showed an improvement varying from 6 percent to 15 percent, most differences being statistically significant. (3) It was concluded that test results following a preview of a lesson are an effective substitute for the interaction between student and teacher that occurs in a classroom. The procedure enables the TV instructor to tailor his presentation to the needs and abilities of his particular student audience. Additional stages of tryout and revision offer the potentiality of a substantial increase in student learning and understanding. (4) The generally low achievement test results on the section covering the demonstrations used in TV lessons suggest the need for research on science demonstrations.

Gropper, George L., and Lumsdaine, Arthur A.

An Experimental Comparison of a Conventional TV Lesson with a Programmed TV Lesson Requiring Active Student Response. Studies in Televised Instruction, Report No. 2. Pittsburgh: Metropolitan Pittsburgh Educational Television Stations WQED-WQEX and American Institute for Research, March 1961. 67 p. (USOE Project No. 336; University Microfilms Pub. No. 62-1080.)

Purpose: To compare the relative effectiveness of a conventional TV lesson and a TV lesson using sequenced or programed material that encouraged active student response.

Procedure; Method: Two different lessons—one on the effects of heat and one on nuclear reactions—were presented over TV using two presentational methods: (1) a conventional method in which the TV lessons were produced and presented in a normal lecture-demonstration manner; (2) a programed method in which the TV lessons were modified to offer students opportunities for active response—either a covert one through thinking the answers, or an overt response in writing their answers on work sheets. In the programed lesson, the teacher paused just prior to the expected responses to allow students time to complete the statements begun. When she paused, a question mark flashed on the screen. The two versions of each of the two different lessons were pre-recorded and telecast simultaneously over two ETV stations on the day each lesson was regularly scheduled to be shown.

Subjects: The subjects were drawn from the seventh and eighth grade students who regularly watched the junior high school science series telecast by the Metropolitan Pittsburgh ETV stations. For the lesson on heat, the sample consisted of three matched classes with a total of 140 cases. For the lesson on nuclear reactions, the sample consisted of 158 students paired off in advance on the basis of sex and intelligence, one member of each pair being randomly assigned to one of the two versions.

Test Measures: Data consisted of scores obtained from achievement tests administered after the telecast. One test was given either the same day or the next as a measure of acquisition. A delayed test was given about a week and a half or two weeks following the telecast as a measure of retention. To test prior knowledge and aid in the preparation of the achievement test, a pretest had been administered to a sample class before the lesson was televised.

Statistics: Analysis of variance was used for testing the differences between groups.

Results and Conclusions: (1) In the immediate post-test for the lesson on *heat*, the experimental programed lesson group scored a significantly superior rating (seven percent) above the conventional group. The *high IQ* students in the programed group averaged 12 percent higher (statistically significant) on the achievement test than the high IQ students in the conventional group. The differences between the *low IQ* students in the two groups were nonsignificant. (2) On the delayed retention test the same significant differences favoring the programed group of *high IQ* students were found. However, a significant difference in favor of the conventional group of *low IQ* students was found. The authors suggest that in programing the material in a fixed-

pace presentation to a group, the lesson may have been too difficult for low IQ students. (3) In five out of six comparisons based on alternative forms of a test administered at three different times following the telecast of the lesson on *nuclear reactions,* the mean performance for the programed group exceeded that of the conventional group. Two of the five comparisons were statistically significant, with a third significant for some schools in the sample. Of the significant overall comparisons, one was a test of acquisition; the other of retention. (4) The authors conclude that, taking the two lessons together, they "jointly tend to lend some support to the value of active response for learning and retention, and would suggest that active student response elicited by a TV lesson that is sequenced or programed appears to contribute to better student learning and retention than a 'conventional' TV lesson can produce."

Gropper, George L., and Lumsdaine, Arthur A.

An Experimental Evaluation of the Contribution of Sequencing, Pre-Testing, and Active Student Responses to the Effectiveness of "Programmed" TV Instruction. Studies in Televised Instruction, Report No. 3. Pittsburgh: Metropolitan Pittsburgh Educational Television Stations WQED-WQEX and American Institute for Research; April 1961. 80 p. (USOE Project No. 336; University Microfilms Pub. No. 62-1081.)

Purpose: To evaluate the contributions to the effectiveness of programed TV instruction made by sequencing, pretesting, and active student response.

Procedure; Method: Three separate experiments were performed: (1) The effectiveness of a *nonprogramed,* conventional TV science lesson entitled "Newton's Laws of Motion" and requiring active student response was compared with that of its counterpart which was identical except that it did not require students to make active responses. In the active response version, the lecturer paused at selected points in the lesson while question marks, flashed on the screen, encouraged students to complete statements he had begun. Students were told to say the answer to themselves, or to fill in blanks on active response workforms. (2) The effectiveness of a *programed and pretested* TV lesson entitled "How Movies Work" and requiring active response was compared with that of an identical lesson which did *not* require active response. The programed lesson was sequenced in small steps requiring students to make correct responses. The mastery of each step enabled students to proceed to the next step. In the active-response version, the lecturer used the same procedure as in the first experiment, and also supplied the missing word or words after the student response. In the control version, students merely listened to the same sequenced and pretested material. (3) A *programed* TV science lesson entitled "Levers" was prepared in three versions: the original, a first revised version modifying the original after a tryout by three students, and a second revised version modified after another such tryout. The effectiveness of the latter two versions was compared. In each experiment, the two alternate versions were pre-recorded and telecast simultaneously over two Pittsburgh ETV stations on the day the lesson was regularly scheduled to be shown.

Subjects: The subjects were drawn from the seventh and eighth grade students who regularly watched the televised junior high school science series. They were paired in advance on the basis of sex and intelligence, one member of each pair being randomly assigned to one of the two rooms. Four classes totaling 150 students from four schools participated in the first experiment; 156 students from three classes in three schools, in the second; and 186 students from four classes in four schools, in the third experiment.

Test Measures: Data were obtained from two forms of an achievement test, one administered the day after the experiment, and the second about two weeks later.

Statistics: Analysis of variance was used for testing differences between groups in the first two experiments and the t-test in the third.

Results: (1) In the experiment to evaluate active response *vs.* passive viewing during a non-programed lesson, no significance differences were found for either the immediate post-test or the retention test on either form of the test. This led to the conclusion that there is "little basis for believing that merely requiring or encouraging students to make active responses, without employing methods to insure that they will be capable of making correct responses, will add to the effectiveness of instruction." (2) Learning was more efficient for students who made active responses during the programed lesson on "Movies" than it was for students who merely listened to and watched an identical programed version. On both a test of acquisition and of retention, the active response group averaged significantly higher achievement test results than did the passive viewing group. These findings suggested that although "it is necessary to program lessons to enable students to make correct, active responses, it is beneficial for learning if students are stimulated to and, in fact, do respond actively." (3) In the experiment to evaluate the first revision *vs.* the second revision of a programed lesson, a significant learning gain was found for the second revised version on the immediate post-test, but not on the retention test—results that suggest some utility of pretesting and revision of programed, fixed-pace TV lessons.

Gropper, George L., and Lumsdaine, Arthur A.

An Investigation of the Role of Selected Variables in Programmed TV Instruction. Studies in Televised Instruction, Report No. 4. Pittsburgh: Metropolitan Pittsburgh Educational Television Stations WQED-WQEX and American Institute for Research; April 1961. 104 p. (USOE Project No. 336; University Microfilms Pub. No. 62-1082.)

Purpose: To evaluate the contributions to effectiveness of programed TV instruction made under conditions of student competition, intermittent feedback of knowledge of results, active *vs.* reading responses, and active responses *vs.* attentive listening.

Procedure; Methods: Four separate experiments were performed with programed (sequenced and pretested) TV lessons: (1) a lesson on airplanes requiring *active student response* and *competition with students in the studio* was compared with an identical lesson which did *not* require active response or compe-

tition. (2) A lesson on satellites requiring *active student response,* but only *intermittent feedback* of the correct results by the instructor (rather than feedback all the time) was compared with an identical lesson which did *not* require active response. (3) A lesson on body chemistry which required students to *construct responses* on a worksheet completing sentences presented on the TV screen, was compared with an identical lesson in which the blanks were already filled in and which the instructor read twice while the students read the sentences silently. (4) A lesson on chemistry which required students to make *active responses* by completing sentences while the instructor paused as a question mark flashed on the screen, was compared with an identical lesson in which there was no pause, but with a triangle—instead of a question mark—flashed on the screen as an *emphasizing signal.* In each experiment, the alternate versions were pre-recorded and telecast simultaneously over the Pittsburgh ETV stations on the day the lessons were regularly scheduled to be shown.

Subjects: The subjects were drawn from the seventh and eighth grade students who regularly watched the junior high school TV science series. They were paired in advance on the basis of sex and intelligence, one member of each group being randomly assigned to one of two rooms. Four classes of 190 students participated in experiment 1, six classes of 224 students in experiment 2, five classes of 150 students in experiment 3, and six classes of 220 students in experiment 4.

Test Measures: Data were obtained from achievement tests administered the day after the experiment and again approximately two weeks later.

Statistics: Analysis of variance was used for testing the differences between the groups.

Results and Conclusions: There were *no* significant differences in either the immediate or delayed tests between the groups being compared on any of the four experiments. It was concluded that the "variables of competition and intermittent feedback may not have been implemented in such a way as to serve their purpose of stimulating responding and may, indeed, have interfered with the ability of the students to respond correctly." The experimenters further concluded that "even though overt responding requires more time than either reading or listening, it may nevertheless be desirable to require constructed, written responses . . . since the assurance of control over student responding provided by a tangible record of responding could be more important for televised instruction than efficiency as measured by amount of material covered per unit of time."

Gropper, George L., and Lumsdaine, Arthur A.

Issues in Programming Instructional Materials for Televised Presentation. Studies in Televised Instruction, Report No. 5. Pittsburgh: Metropolitan Pittsburgh Educational Television Stations WQED-WQEX and American Institute for Research, May 1961. 32 p. (USOE Project No. 336; University Microfilms Pub. No. 62-1083.)

Purpose: To explore some issues involved in programing learning sequences for television.

Procedure: To draw on relevant discussion and evidence from research described in this series of studies, from teaching machine research, and from instructional film research.

Conclusions: (1) The basic objectives and functions of programed auto-instruction are control of learning conditions and accommodation of individual differences. (2) The objectives in applying programing procedures to television are (a) to make maximum use of TV's audiovisual capability; (b) to retain the logistic advantage of being able to reach large groups of students at the same time; (c) to build elements of systematic control into the instructional situation, and (d) to devise procedures that—despite group viewing—will, to an appreciable degree, accommodate individual differences in ability to learn. (3) The physical characteristics of the TV medium are (a) a fixed pace of content development; (b) the capability of physically controlling the presentation of both visual and auditory stimuli; (c) a measure of control over student responses through adjuncts to the televised presentations; (d) the capability of providing confirmatory reinforcement of student responses, subject to two limitations: confirmation will occur whether or not students have responded, or have responded correctly; control over the time permitted the student to respond is lacking. (4) The programing techniques applicable to auto-instruction with teaching machines should, in general, be applicable to TV. When so transferred, the problems and issues found in the one medium are likely to be transferred to the other. Some advantages, some problems, and some practical and theoretical considerations appear to be superimposed when programed instruction is presented over TV at a fixed rate, is presented orally, and is presented to groups of students. Separate research on these issues will probably be required.

Gropper, George L.; Lumsdaine, Arthur A.; Willis, Yolanda; and Willis, Richard H.

An Evaluation of Television Procedures Designed to Stimulate Extracurricular Science Activities. Studies in Televised Instruction, Report No. 6. Pittsburgh: Metropolitan Pittsburgh Educational Television Stations WQED-WQEX and American Institute for Research; May 1961. 58 p. (USOE Project No. 336; University Microfilms Pub. No. 62-1084.)

Purpose: To evaluate the effectiveness of three procedures designed to stimulate students to perform on their own certain experiments that they have seen demonstrated during televised science lessons in school.

Procedure; Method: Six physical science experiments were prepared for presentation on a TV science program. Three experimental variables were introduced in connection with the lesson: (1) *Student vs. adult demonstrator:* In the control version an adult teacher performed and described the six experiments; in the experimental version, students of the same age as the audience performed the experiments while the off-stage teachers described them. (2) *Complete vs. incomplete experiments:* In the experimental-student-

presented version, three of the six experiments were performed to completion with results clearly described; the three remaining experiments were presented only partially, with the question then put to the viewing audience as to what the outcome might be. (3) *Ease of access to experimental materials:* Following the telecast, students were asked to identify the one experiment they would most like to try at home, and kits of materials and instructions were made available to them in one of three ways: (a) some students were *automatically* given the selected kit; (b) some were *given a postcard* addressed to the TV station, and were told they would receive the kit if they sent the card; and (c) some were told they would receive the kit if they sent in a *postcard which they had* to provide themselves. The pre-recorded TV programs were presented within the context of a year-long junior high school science series over the two Pittsburgh ETV stations as part of a "Fun Day" program.

Subjects: Subjects were seventh and eighth grade students. Eight pairs of classes participated, total class sampling being employed with the assignment of *intact* classes to either the control or experimental conditions.

Test Measures: Before viewing the telecast, all students filled out a questionnaire designed to measure their interest in, or preference for science. Following the telecast, they filled out other questionnaires in which they named their favorite experiments. About two weeks later they filled out a third questionnaire primarily to determine whether they had performed one of the six experiments at home.

Statistics: Analysis of variance and chi-square were used for testing the differences between groups.

Results: (1) Girls who had watched the adult demonstrator showed a statistically significant greater increase in *preference* for science than did the girls who had watched the student demonstrators. This result was not duplicated by the boys. (2) Significantly more students (84 percent) were influenced to perform the experiment *at home* after seeing fellow students perform than those who had seen the adult instructor perform them (69 percent). (3) The providing of kits or postcards to students resulted in a statistically significant increase in preference for science; students who received neither kit nor postcard showed no improvement. (4) Significantly more students were influenced to perform the experiment *at home* when they received the kit (87 percent) or postcard (69 percent) than when they received neither (37 percent). (5) In the "no kit" group, 80 percent of those who had watched student demonstrators reported they performed the experiment as opposed to only 21 percent who had watched the adult demonstrator. (6) To leave experiments *incomplete* appears to have an *adverse effect* in stimulating interest in them. (7) The following conclusions were drawn: "Techniques such as those employed in this study can . . . induce students to perform experiments on their own. Use of student demonstrators to encourage their confidence in doing so," and readily available materials were shown to be important.

Gropper, George L., and Lumsdaine, Arthur A.

The Use of Student Response to Improve Televised Instruction: an Overview. Studies in Televised Instruction, Report No. 7. Pittsburgh: Metropolitan Pittsburgh Educational Television Stations WQED-WQEX and American Institute for Research, June 1961. 32 p. (USOE Project No. 336; University Microfilms Pub. No. 62-1085.)

Purpose: To *summarize* a series of 12 separate experiments which explored several techniques for using student response to improve televised instruction.

Procedure: A series of junior high school science lessons was televised throughout the school year. For each experiment two alternative versions of a lesson were prepared. The experimental version was shown over WQED. It was compared with the second version—the standard or control lesson—simultaneously telecast over WQEX. With such controlled comparisons, it was possible to evaluate the effectiveness of the various experimental techniques which employed student performance to improve the quality of instruction. Three types of studies were conducted: (1) A lesson was pretested over the air; the instructor used the results to improve it; the revised lesson was then compared with the preview version. (2) Special lessons, developed in much the same way as those prepared for teaching machines, required students to answer questions and complete statements during the telecast; these versions were compared with non-programed versions. (3) Techniques designed to stimulate student extracurricular activities after the telecast were compared with techniques not so designed.

Results and Conclusions: (1) The pretested lesson when revised produced significant improvements on various parts of the quiz, ranging from 6 to 26 percent. The researchers concluded that student performance during tryouts—when used as feedback to the instructor—enabled him to tailor his presentation to a particular audience. (2) A learning-by-doing technique for programed TV lessons proved to be significantly better than the conventional TV lecture presentation. (3) The techniques designed to stimulate extracurricular activities were judged effective when students actually performed experiments they had seen demonstrated on TV. Two such techniques were the use of student demonstrators rather than an adult demonstrator, and the provision of kits and instructions needed to perform experiments at home. The results indicated that the more readily available the wherewithal to perform experiments, the more likely were students to perform them. (4) The authors concluded that student "performance was effectively used before, during, and after TV lessons as a means of evaluating the adequacy of and as a means of improving televised instruction. More effective use of educational television can result from systematic attention to its methods for stimulating appropriate student responses, and for altering or revising instructional programs until students do, in fact, attain the capability of making these responses."

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